Americ Gramophone Co. [1891?] - 1893

Toy Graphophone introd
at same time as this
case -

Note Mauros testimony re possible Berliner
suit vs. Metaphone & the possibility that
this sparked this suit - esp. since claim
21 had been sustained in that suit.
p 210-211.
Suit had to be delayed until end of
Leeds & Baldwin suit.

United States. Circuit Court.
Southern District of New York.

American Graphophone Co.) In Equity
versus) No.7063
The National Gramophone Co.)
& Frank Seaman)

U. S. Circuit Court of Appeals
for the Second Circuit

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Center, New York.
Also patents from other
documents or cases as is the case with
the Berliner Franklin
Institute article.

American Graphophone Company
-vs.-
The National Gramophone Company
& Frank Seaman.

R. N. Dyer.

Letters Patent
No. 341,214.

1898.

20/chg.	Oct.	22	Filed Bill & praecipe & issued subpoena.
	..	27	.. subpoena, p.s. N.G. Co. Oct. 25 - F.S. Oct. 26th
.50 pd	Nov	12	" Complts. Mo. papers on Mo. for prelim. injunc, with return U.S.M. p.s. depts -
25 pd.	Dec.	6.	.. & Ent appce. Mitchell Bartlett & Brownell Sols. for Defts. Seaman
25 pd.	..	5.	.. .. .. W. G. Morse Sol. for N.G. Co.
	..	10	.. Opinion Lacombe J.
30 chg	..	10	.. affdts. & ex. on motion.
13 chg	..	10	.. do do do.
20 chg	-	10	- (10) Exhibits.
10 chg.	..	15	.. Notice withdrawal of claims 19-20-22-&-23
25 chg.	..	15	- & Ent Order for prelim injunc.
25 pd	..	16	.. .. suspending injunc.
0 chg	..	31	.. Answer.
0 pd	99 Jany	5	- Ans. of Nat. Gram. Co.

0 chg.	..	15	..	Notice withdrawal of claims 19-20-22-& 23
25 chg	..	15	–	& Ent Order for prelim injunc.
25 pd	..	16	..	.. – – suspending injunc.
0 chg	"	31	..	Answer.
0 pd	99 Jany	5	–	Ans. of Nat. Gram. Co.
0 pd	"	9th	.	Replication. "
0 pd.	,	9th	"	do.
0 pd.	Mch	10	"	Mandate.
100 chg		16	"	& Ent. Order on Mandate (3769.)
85 pd.	1900 May	5	" " "	Final decree against our deft (Nat Gramophone Co)
25 chg	Oct	19	"	& Ent Order granting deft until Dec 18, 1900 to complete testimony
25 pd	Nov	16	"	& Ent Order that if petition is denied defts time to complete testimony be extended as many days as the presentation of said petition shall be postponed at the request of Complts counsel
1.50 chg.	Dec	10	"	Pet & No of Mo to withdraw proofs etc file by Berliner Gr. Co. & U.S. Gr. Co.
10 chg		10	"	Affs of Philip Mauro
10 chg		10	"	Affs of Frank Seaman
		10	"	Opinion (Lacombe J.) Granting Application to withdraw appearances of counsel for Mr Seaman & and denying Mo to withdraw documents etc, filed with Officers of the Court See Opinion on file.

1090

American Graphophone Co.,
Complainant-Appellee,
vs.
The National Gramophone Co.,
et al.
Defendants-Appellants.

Richard N. Dyer.
Circuit So. N.Y.
Mitchell Bartlett & Brownell.

1898
Dec 19 Filed transcript of record. Cl. Sd. [illegible]
50 " 22 " copies of record. Served both sides.
" 23 Ordered on calendar in open Court
25 Jan 9 Entered appearance appellee by R. N. Dyer
" 9 Filed and brief [illegible]
5 10 " 21 " " Appellee
Feb [illegible] Decree of Circuit Court reversed with costs. Opinion Shipman J.
75 " 6 Filed stipulation removing exhibits
" 9 " rendered order for mandate.
" 9 " bill of costs
" 9 Issued mandate
Closed 6/30/99. $ [illegible]

(45) ~~1090~~ 122 Judge Lacombe.

United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE AMERICAN GRAPHOPHONE COMPANY,
Complainant-Appellee,

vs.

THE NATIONAL GRAMAPHONE COMPANY
AND FRANK SEAMAN,
Defendants-Appellants.

TRANSCRIPT OF RECORD.

Appeal from the Circuit Court of the United States for the Southern District of New York.

PRINTED UNDER THE DIRECTION OF THE CLERK.

DEC
22

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TO THE DEFEND

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United States Circuit Court.

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY,
Complainant,
vs.
NATIONAL GRAMOPHONE COMPANY
and FRANK SEAMAN,
Defendants.
In Equity.

TO THE DEFENDANTS:

Take notice, that on the bill of complaint and the affidavits of Andrew Devine, Edward D. Easton, Philip Mauro, C. A. L. Massie, Shelton T. Cameron, Arthur S. Browne and Arthur J. Hall, copies of which are herewith served upon you, I shall move this Honorable Court at the Court Rooms of the Court, in the Borough of Manhattan, on Friday, the 18th day of November, 1898, at the opening of the Court on said day, or as soon thereafter as counsel can be heard, for a preliminary injunction on claims 19, 20, 21, 22 and 23 of Patent No. 341,214, and for other relief.

Yours, &c.,
RICHARD N. DYER,
Solicitor for Complainant.

New York, November 11, 1898.

TO THE DEFENDANTS:

The model exhibits referred to in the affidavits of Andrew Devine and C. A. L. Massie may be inspected at my office, No. 31 Nassau Street, Borough of Manhattan.

RICHARD N. DYER.

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IN THE UNITED STATES CIRCUIT COURT,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

Bill of Complaint.

TO THE HONORABLE THE JUDGES OF THE CIRCUIT COURT OF THE UNITED STATES FOR THE SOUTHERN DISTRICT OF NEW YORK: 6

The American Graphophone Company, a corporation duly organized and existing under the laws of the State of West Virginia, and having its principal office at Washington City, in the District of Columbia, brings this its bill of complaint against the National Gramophone Company, a corporation organized and existing under the laws of the State of New York, and having its principal place of business in New York City, in said State, and Frank Seaman, individually and as
7 President of said company, said Seaman being a resident of Yonkers, in the State of New York, and doing business in the City of New York, and both said National Gramophone Company and Frank Seaman being inhabitants of the said Southern District of New York.

And thereupon your orator complains and says:

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1.

That Chichester A. Bell and Sumner Tainter, then of Washington aforesaid, were the original, first and joint inventors of certain new and useful improvements in recording and reproducing speech and other sounds, which improvements were not known or used by others in this country before their invention thereof, and were not patented or described in any printed publication in this or any foreign country before their invention thereof, and were not in public use or on sale in the United States for more than two years prior to their

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application for a patent therefor, and which had not been abandoned.

2.

That thereafter the said Chichester A. Bell and Sumner Tainter made application in due form of law to the Commissioner of Patents for the grant of Letters Patent of the United States for the said invention, and then and there fully complied in all respects with the provisions and requirements of the laws of the United States in such case made and provided; that thereupon, due proceedings being had upon said application, Letters Patent of the United States, in due form of law, were issued and delivered to the said Chichester A. Bell and Sumner Tainter in the name of the United States of America, under the seal of the Patent Office, and signed and countersigned respectively by the proper officers of the United States, number 341,-214, and dated May 4th, 1886; and that the said Letters Patent did grant to the said Chichester A. Bell and Sumner Tainter, their heirs and assigns, for a term of seventeen years from the said 4th day of May, 1886, the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof, as by reference to the said Letters Patent or a duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear.

3.

That the said Sumner Tainter was further the original, first and sole inventor of a certain new and useful improvement in apparatus for recording or reproducing sounds or sonorous vibrations, not known or used by others in this country, or patented or described in any printed publication in this or any foreign country, prior to his ininvention thereof, and not in public use or on sale in the United States for more than two years prior to his

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13 application for Letters Patent therefor, and which had not been abandoned to the public.

4.

That on the 4th day of December, 1885, said Sumner Tainter made application in due form of law to the Commissioner of Patent for the grant of Letters Patent of the United States for the said invention, and 14 then and there fully complied in all respects with the requirements and provisions of the laws of the United States in such case made and provided; that due proceedings upon said application being had upon the 4th day of May, 1886, Letters Patent of the United States, in due form of law, were issued and delivered to said Sumner Tainter, in the name of the United States, and numbered 341,288, granting to said Sumner Tainter, his heirs or assigns, for the term of seventeen years from the said 4th day of May, 1886, the full and ex- 15 clusive right to make, use and vend the said invention throughout the United States and the Territories thereof, as by reference to said Letters Patent, or a duly authenticated copy thereof here in Court to be produced, will more fully appear.

5.

That the said Charles Sumner Tainter was, further, 16 the original, first and sole inventor of a certain new and useful improvement in apparatus for recording and reproducing speech and other sounds not known or used by others in this country, or patented or described in any printed publication in this or any foreign country before his invention thereof, and not in public use or on sale in the United States for more than two years prior to his application for Letters Patent therefor, and which had not been abandoned to the public.

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6.

That on the 7th day of July, 1887, said Charles Sumner Tainter made application in due form of law to the Commissioner of Patents for a grant of Letters Patent of the United States for said invention, and then and there fully complied in all respects with the requirements and provisions of the laws of the United States in such case made and provided.

That thereupon, due proceedings being had upon 18
said application, Letters Patent of the United States,
in due form of law, were issued and delivered to the
said Charles Sumner Tainter in the name of the United
States of America, under the seal of the Patent Office,
and signed and countersigned by the proper officers of
the United States, numbered 375,579, and dated De-
cember 27, 1887, granting to said Charles Sumner
Tainter, his heirs or assigns, for the term of seven-
teen years from said 27th day of December, 1887, the
full and exclusive right to make, use and vend the said 19
invention throughout the United States and Territories
thereof, as by reference to said Letters Patent, or a
duly authenticated copy thereof here in Court to be
produced, will more fully and at large appear.

7.

That the inventions or improvements described in
said Letters Patent No. 341,214 to Chichester A. Bell
and Sumner Tainter, and Nos. 341,288 and 375,579 to 20
Sumner Tainter were designed for and are capable of
conjoint use, and are used conjointly by defendants in
apparatus for recording speech and other sounds.

8.

And, your orator further shows that on the 29th day of March, 1887, said Chichester A. Bell and Sumner Tainter, by an instrument in writing, duly signed and delivered, and recorded in the United States Patent Office the 22d day of Sep-

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21 tember, 1887, did give, grant and convey to the Volta Graphophone Company, a corporation organized and existing under the laws of the State of Virginia, its successors and assigns, the entire right, title and interest in and to said Letters Patent No. 341,214, granted to them as aforesaid, and in and to the invention secured thereby, as by reference to said instrument, or a duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear.

22

9.

That on the 29th day of March, 1887, said Sumner Tainter, by an instrument in writing, duly signed and delivered and recorded in the United States Patent Office the 5th day of April, 1887, did give, grant, assign and convey to the said Volta Graphophone Company, its successors and assigns, the entire right, title and interest in and to said Letters Patent No. 341,288, 23 granted to him as aforesaid, and in and to the invention secured thereby, as by reference to said instrument, or a duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear.

10.

That on the 31st day of January, 1888, said Charles Sumner Tainter, by an instrument in writing duly signed and delivered, and recorded in the United 24 States Patent Office the 21st day of February, 1888, did give, grant, assign and convey to the said Volta Graphophone Company, its successors and assigns, the entire right, title and interest in and to said Letters Patent No. 375,579, granted to him as aforesaid, and in and to the invention secured thereby, as by reference to said instrument, or a duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear.

That on the 24th
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writing, duly signe
corded in the Unite
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No. 341,288 and No.
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l convey to the Volta ration organized and State of Virginia, its e right, title and inter- No. 341,214, granted and to the invention to said instrument, or f, here in Court to be large appear.

n, 1887, said Sumner ting, duly signed and United States Patent , did give, grant, as- a Graphophone Com- , the entire right, title ers Patent No. 341,288, in and to the inven- rence to said instru- copy thereof, here in fully and at large ap-

ry 1888, said Charles ment in writing duly orded in the United ay of February, 1888, ey to the said Volta essors and assigns, the and to said Letters im as aforesaid, and thereby, as by refer- ly authenticated copy uced, will more fully

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11.

That on the 24th day of January, 1893, the said The Volta Graphophone Company, by an instrument in writing, duly signed, sealed and delivered, and recorded in the United States Patent Office the 25th day of January, 1893, did give, grant, assign and convey to your orator, its successors and assigns, the entire right, title and interest to said Letters Patent No. 341,214, No. 341,288 and No. 375,579, and in and to the inventions secured thereby, as by reference to said instrument, or a duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear.

12.

That your orator has been, ever since the date of the assignment last mentioned, and was, at the time of the commission of the acts hereinafter complained of, and is now, the sole and exclusive owner of the said Letters Patent and of all claims for infringement thereof; and has been, and is, save for the doings of these defendants and others acting in concert with them, in the exclusive possession of said rights and privileges, and is entitled to the exclusive use, benefits and advantages of the said inventions and improvements, and to sue for and recover to its own use and in its own name all claims for the infringement or violation thereof.

13.

And your orator further shows that it has expended large sums of money in practicing said invention and introducing the same into public use, and the same is of great commercial value and practical utility; that a great public interest has been manifested therein, and a large demand created for apparatus constructed in accordance with or embodying the same, which demand your orator is ready and able to supply; that

29 the public, generally, in all parts of the United States, have recognized and acquiesced in the facts that the said Bell and Tainter were the first and original inventors of the said inventions, and that the patents above named are good and valid patents, and that the public have also acknowledged the claims of your orator to the exclusive right to said inventions under said patents, and that, but for the infringements and wrongs hereinafter complained of, your orator 30 would now be in the peaceful possession and enjoyment of the said Letters Patent and inventions and of the income derivable therefrom.

14.

Your orator further shows that on the 8th day of October, 1896, it filed its bill of complaint in this Court against Loring L. Leeds and others for infringement of Patent No. 341,214 here in suit by the manu- 31 facture, sale and use of a machine known as the "Metaphone;" that said defendants duly appeared and answered; that replication was filed, proofs taken, and the cause was brought on before the Hon. NATHANIAL SHIPMAN, Circuit Judge; that on or about the fourth day of August, 1898, a decree was duly entered establishing the validity of said Letters Patent (particularly as to claims 19, 20, 21, 22, 23 and 24) and the title of your orator therein, the fact of the infringement thereof by the said defendants therein, and award- 32 ing a perpetual injunction; which said decree now remains in full force and effect, as by duly authenticated copy thereof, here in Court to be produced, will more fully and at large appear; that a writ of injunction in accordance with said decree duly issued against said defendants, was served and now remains in full force and effect.

15.

And your orator further shows, upon information and belief, that the defendants *The National Gramo-*

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The National Gramo-

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phone Company and *Frank Seaman*, and others acting in concert with them, well knowing the premises since the grant of said Letters Patent and since the acquiring by your orator of its title thereto, as hereinbefore set forth, within the said Southern District of New York and elsewhere in the United States, wrongfully and unlawfully and with the intent to injure your orator and to deprive it of the just profits resulting from said inventions, which profits otherwise would accrue to it from the 34 practice of said invention, and without the license or consent of your orator, have both jointly and severally made, used and vended sound records and apparatus for recording and reproducing speech and other sounds, substantially as described in said Letters Patent Nos. 341,214, 341,288 and 375,579, and that they still continue so to do, and are threatening to continue the aforesaid unlawful acts to a still larger extent, all in defiance of the rights secured to your orator as aforesaid, and to its great and irreparable 35 loss and injury, by which your orator has been and still is being deprived of great gains and profits that it would otherwise have obtained but for the aforesaid unlawful doings of the defendant; and your orator further shows that the said defendants, and each of them, have derived and received, and still are deriving and receiving, great gains and profits from such unlawful acts, but to what extent, your orator is ignorant and cannot set forth, and, therefore, it prays a discovery thereof. 36

16.

And your orator further shows unto your Honors that the manufacture, use and sale by the said defendants of sound-records and apparatus for recording and reproducing sound embodying, employing or containing the inventions set forth in said Letters Patent Nos. 341,214, 341,288 and 375,579, and their preparation for

37 continuing, and their avowed determination to continue, the same and other aforesaid unlawful acts, in disregard and defiance of the rights of your orator, have the effect to, and do, encourage and induce others to venture to infringe said Letters Patent.

17.

38 And your orator further shows, upon information and belief, that your orator and all persons making under the authority of your orator apparatus for recording and reproducing sounds and sound-records, employing, embodying and operating or made in accordance with the inventions described and claimed in the Letters Patent aforesaid, have given notice to the public that the same are patented, and have affixed thereto the word "patented," together with the day and year the said patents respectively were 39 granted; and your orator further shows that the said defendants were duly notified of their infringement herein complained of, but refused to desist therefrom and still continue so to do.

And your orator therefore prays as follows:

1. That the said defendants, and each of them, be required by a decree of this Honorable Court to account for and pay over to your orator such gains and 40 profits as have accrued or arisen, or been earned or received by the said defendants, and each of them, and all such gains and profits as would have accrued to your orator but for the unlawful doings of said defendants, and all damages your orator has sustained thereby; and

2. That the defendants and each of them may be compelled, by the order of this Honorable Court, to deliver up to the judicial custody for destruction, in manner to be provided for in said order, all infringing

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41 apparatus and sound records, in the possession of, or under the control of, said defendants and each of them.

3. That the defendants, and each of them, their associates, attorneys, servants, clerks, agents and workmen, may be perpetually enjoined and restrained, by a writ of injunction issuing out of and under the seal of this Honorable Court, from directly or indirectly making or causing to be made, using or causing to be used, selling or causing to be sold, any 42 machine or apparatus or sound record, embodying or constructed or operating in accordance with the inventions or improvements set forth in the Letters Patent aforesaid, or either of them ;

4. That your Honors will grant unto your orator a preliminary injunction, issuing out of and under the seal of this Honorable Court, enjoining and restraining the said defendants, and each of them, their associates, servants, clerks, agents and workmen, to the 43 same purport, tenor and effect as hereinbefore prayed for with regard to said perpetual injunction ; and

5. That these defendants be decreed to pay the costs of this suit ; and

6. That your orator may have such other and further relief as the equity of the case may require.

44 To the end, therefore, that the defendants may, if they can, show why your orator should not have the relief hereby prayed, and may full, true and direct answer make—but not under oath, answer under oath being expressly waived—according to the best and utmost of their knowledge, information, remembrance and belief, to the several matters hereinbefore averred and set forth, as fully and particularly as if the same were repeated, paragraph by paragraph, and said defendants thereto severally and specifically interrogated, may it please your Honors to grant your orator a writ of

45 *subpœna ad respondendum*, issuing out of and under the seal of this Honorable Court, directed to said defendants The National Gramophone Company and Frank Seaman, and each of them, commanding them to appear and make answer to this bill of complaint, and to perform and abide by such order and decree herein as to this Court may seem just.

And your orator will ever pray.

AMERICAN GRAPHOPHONE CO.,
46 [SEAL OF A. G. CO.] by E. D. EASTON,
President.

RICHD. N. DYER,
Solicitor for Complainant.
RICHD. N. DYER,
S. O. EDMONDS,
Of Counsel.

47

STATE OF NEW YORK, }
County of New York, } ss.:

EDWARD D. EASTON, being duly sworn, deposes and says that he is president of the American Graphophone Company, named as complainant in the foregoing bill; that he has read the same and knows the contents thereof, and that the same is true of his own knowledge, save of the matters therein stated to be
48 alleged upon information and belief, and that as to those matters he believes it to be true; and that the seal affixed to said bill is the corporate seal of said complainant, and was by him affixed to the bill by authority of said corporation.

ELISHA K. CAMP,
[SEAL.] Notary Public,
N. Y. Co.

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IN THE CIRCUIT COURT OF THE UNITED STATES

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE CO.
v.
THE NATIONAL GRAMOPHONE CO.
ET AL.
In Equity. 50

Affidavit of Andrew Devine.

COUNTY AND STATE OF NEW YORK, ss.:

ANDREW DEVINE, being duly sworn, says:

I reside in Brooklyn, N. Y. 51

I was one of the first users of the Graphophone, and I was the first person to apply a talking machine to any practical use. This was in the year 1888, and the use to which I refer was the transcription of proceedings in the U. S. House of Representatives, of which I was at that time an official reporter.

From that time to the present I have taken a deep interest in the development of the talking machine, and have followed closely every step of its progress. I have familiarized myself with all types of machines 52 that have been produced, testing their relative merits by use and experiment.

I am familiar with the development of the machine known as the "Gramophone," and am personally acquainted with Mr. Emile Berliner, of Washington, the inventor. Mr. Berliner's efforts to reduce to practice the idea, published by Chas. Cros, of Paris, 1878, of making permanent sound-records by tracing in a fatty film and then etching in metal, have attracted much attention, through the published writings of Mr.

53 Berliner, and by reason of his reputation as a man of science. For many years the result of those efforts gave no promise of industrial results, inasmuch as the reproduced sounds bore but a remote and uncouth resemblance to the originals. His work was therefore regarded generally as of scientific interest merely, and not as having any practical bearing.

Within the past year, however, the system has been improved to such an extent that, for certain kinds of
54 sounds, it serves for purposes of entertainment. A machine of this type is now before me, being marked "Complainant's Exhibit Defendants' Machine. It has the parts common to all talking-machines; namely, a rotating tablet-holder, a motor for rotating it, a reproducing diaphragm and stylus, and a sound-conveying tube. Its prominent operative feature is the support or arm which carries the reproducer, and the essential characteristic of this feature is that the arm, or support is loosely mounted on a universal
55 joint, so that it rests by gravity on the tablet, and is adjustable side-wise and capable of being freely guided by the sound-groove. In this respect it is similar to the Graphophone and embodies the "floating," or "gravity" or "freely-mounted" reproducer, which is one of the most important features of the Graphophone, and has proved to be indispensable to a practical talking-machine. In the details of its construction the reproducer-support of the Gramophone is practically identical with the defendants' device (known as
56 the "Metaphone," or "Echophone") in *American Graphophone Company vs. Leeds and Baldwin*, in which a final decree was entered in this Court in August, 1898. In both these devices the reproducer is carried on the end of a long pivoted arm, resting by gravity on the tablet, and capable of swinging on its pivot across the entire face of the tablet, the groove in the latter effecting the feed of the reproducer.

I am familiar with the machines and records sold or offered for sale by the defendants at their place of business, on Broadway and 17th Streets, in this City, 57 and described in their circulars and advertisements. A machine now before me and marked "Complainants' Exhibit Defendants' Machine," with the title of this cause, is one of said machines, and a record marked "Complainant's Exhibit Defendants' Record" is one of said records.

ANDREW DEVINE.

Subscribed and sworn to before me, a notary public, this Ninth day of November, 1898.

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ELISHA K. CAMP,
[SEAL.] Notary Public.
N. Y. Co.

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CIRCUIT COURT OF THE UNITED STATES,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs. } In Equity.
62 NATIONAL GRAMOPHONE CO. ET AL.

STATE OF NEW YORK, }
County of New York, } ss. :

Affidavit of Edward D. Easton.

EDWARD D. EASTON, being duly sworn, deposes and
63 says :

I am of lawful age, and reside at Arcola, Bergen County, New Jersey. I am now, and have been for the past five or six years, President and General Manager of the American Graphophone Company, complainant herein.

I have been actively engaged in the talking-machine business ever since the beginning thereof, and am thoroughly familiar with the history and development of that business in all its details.

64 The complainant company has expended very large sums of money in making Graphophones and supplies favorably known to the public in the United States and in foreign countries, by maintaining offices and salesrooms in the principal cities, by extensive advertising, and by the efforts of a large number of traveling agents. As a result the name "Graphophone" is widely and favorably known. The Company has also invested and expended large sums of money in defending its rights and franchises against infringers.

I have been at all times familiar with the development of the talking-machine known as the "Gramophone." This machine was regarded by practical men as purely an experiment, and it had, until recently, no commercial standing whatever. It is only within the last year or two that certain improvements in detail have rendered this machine salable, and within that period the sale of these instruments has been actively pushed by the usual methods. 65

I have lately become aware that the presence upon the market of an apparatus for reproducing sounds, whose principal operative element is an infringement of the patents of complainant, and which is sold under a name so closely resembling the name "Graphophone" as easily to confuse and mislead the ordinary purchaser, is a cause of loss and injury to the complainant. 66

I am informed and believe that the National Gramophone Company, one of the defendants herein, is engaged solely in selling and distributing gramophones and gramophone supplies, which are manufactured elsewhere, and large quantities of which are distributed outside of the jurisdiction of this Court; that the profits derived from this business are immediately distributed in the form of dividends; and that the said Company has no plant or other tangible assets. The active man in the business is Mr. Frank Seaman, the co-defendant, who is the sole sales-agent of the manufacturing or parent company, and who conducts his business through the National Gramophone Company. 67

68

EDWARD D. EASTON.

Sworn to and subscribed be-
fore me this 9th day of
November, 1898.

ELISHA K. CAMP,
[SEAL.] Notary Public,
N. Y. Co.

69

IN THE UNITED STATES CIRCUIT COURT,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE CO.
v.
70 THE NATIONAL GRAMOPHONE CO.
ET AL.
} In Equity.

Affidavit of Philip Mauro.

CITY AND COUNTY OF NEW YORK, SS.:

PHILIP MAURO, being duly sworn, says:

I reside in Washington D. C., and am general counsel of the complainant herein. 71

Prior to 1893 the efforts that had been made to introduce talking machines into practical use had proved unsuccessful as business ventures, and the era of commercial success with the complainant dates from that year. From that time to the present the patents here in suit have been continuously involved in strenuous and active litigation. In February, 1893, suits were begun under these patents against the Edison Phonograph interests, which suits, after testimony amounting to about 800 printed pages had been taken and after argument on final hearing, were terminated in December, 1896, by a consent decree sustaining the patents. 72

In January, 1896, suit was begun in Chicago against E. H. Amet for the manufacture of a type of reproducing machine which has been known as the "Metaphone" or "Echophone." This suit directly involved the particular claims of Patent No. 341,214 of which infringement is charged herein. This suit went to final hearing on a short record in which affidavits were used in lieu of depositions, and a final decree in favor of complainant was entered May 4, 1896, which, after rehearing, was confirmed and made absolute on January 4, 1897. 73

Meanwhile, the exploitation of the Metaphone or Echophone was undertaken by L. L. Leeds and Leroy W. Baldwin in New York City, and in October, 1896, suit was begun against these individuals in this Court, and application was made for a preliminary injunction. This was denied by the Court upon a showing that the 74 prior art had not been exhaustively considered by the Court in Chicago, and that much new evidence would be produced. This suit was actively pressed by complainant, a record of nearly seven hundred pages was made up, and the case came for final hearing before Judge SHIPMAN in May, 1898. On August 4, 1898, the final decree sustaining (among others) the claims of Patent No. 341,214, here sued on (namely claims 19, 20, 21, 22 and 23), was entered.

PHILIP MAURO. 75

Sworn to and subscribed before me this ninth day of November, 1898.

ELISHA K. CAMP,
Notary Public,
N. Y. Co.

[SEAL.]

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HARTFORD, June 30, 1898.

TO THE COUNSEL IN AMERICAN GRAPHOPHONE CO. V. LEEDS & BALDWIN:

GENTLEMEN—I have filed with the Clerk of the Court an interlocutory decree. I have not inserted the name of a Master for the accounting, but prefer that you should agree upon a Master. If you do not agree, I will fill the blank.

78 In regard to the necessity or propriety of compelling a disclaimer of claims 37 and 38, there is, in my opinion, no call for a disclaimer. The improvements described in these claims were new; the patentees invented them were the first and original inventors, but the improvements were not patentable. The statute in regard to a disclaimer was intended to relate to a different class of defective claims.

In regard to costs. Claims 37 and 38 were for very minor things. They occupied a small place in the 79 record and in the argument. It would not be just to refuse costs when the substantial claims had been declared valid, because two little ones were considered not patentable.

Inasmuch as those claims were in the record, I think it proper to state their invalidity in the decree, though it is an interlocutory one.

Will Mr. Mauro kindly send this letter, when read, to Mr. Parker Smith?

Yours truly,
N. SHIPMAN.

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81 At a Stated Term of the United States Circuit Court for the Southern District of New York, in the Second Circuit, held at the United States Court Rooms, in the City of New York, Borough of Manhattan, on the 30th day of June, 1898.

Present—HON. NATHANIEL SHIPMAN, Circuit Judge.

82

AMERICAN GRAPHOPHONE COMPANY

vs.

LORING L. LEEDS and LEROY W. BALDWIN.

} In Equity.

This cause came on to be heard on the 25th day of April, 1898, upon pleadings and proofs, and was argued 83 by Philip Mauro, Esq., for Complainant, and by William Houston Kenyon, Esq., and A. Parker-Smith, Esq., for Defendants, and the pleadings and proofs, as well as the briefs of counsel, having been fully considered, and the Court being fully advised in the premises, it is hereby ordered, adjudged and decreed as follows:

That the complainant American Graphophone Company, a corporation organized under the laws of West Virginia, is the sole and exclusive owner of letters 84 patent No. 341,214, bearing date of the 4th day of May, 1886, and being for new and useful improvements in recording and reproducing speech and other sounds, and apparatus therefor, as set forth in the bill of complaint, and that said letters patent are valid so far as claims 19, 20, 21, 22, 23 and 24 are concerned.

That defendants Loring L. Leeds and Leroy W. Baldwin have infringed said letters patent, and particularly the above-specified claims thereof, by the manufacture, use and sale of machines adapted to reproduce

85 sounds from a grooved tablet or other body having a sound record formed therein substantially as described in said letters patent, said machines being identified as "Complainant's Exhibit Defendants' Machine."

It is further ordered, adjudged and decreed that the defendants Loring L. Leeds and Leroy W. Baldwin, their and each of their attorneys, trustees, agents, clerks, employees, servants and workmen, and each and every of them, be, and they are hereby, enjoined for
86 the remainder of the term of said letters patent from making, using or selling, and from causing to be made, used or sold, any talking machines, or appliances or part or parts thereof, so containing or embodying the said invention, and that the complainant recover from the defendants as well the damages sustained in and by reason of said infringements as the profits, amounts and savings made and realized by the defendants thereby, together with the costs herein to be taxed, and that the cause be referred to JOHN A. SHIELDS, a
87 Standing Master of this Court, by consent of counsel for the respective parties, to take, state and report the account of damages and profits under and in accordance with this decree.

It is further adjudged that, because the improvements specified in claims 37 and 38 of said patent do not possess the element of patentable invention, said claims are invalid.

N. SHIPMAN,
Circuit Judge.

88

[ENDORSED:] Circuit Court of the U. S., So. Dist. of New York. American Graphophone Co. vs. Leeds & Baldwin. Decree. Anthony Pollok, Philip Mauro, Counsel for Complainant. Lee & Lee, Solicitors for Complainant. U. S. Circuit Court, Filed Jul. 1, 1898, John A. Shields, Clerk.

A copy of the original decree, and letter of Hon. NATHANIEL SHIPMAN annexed thereto, on file.

JOHN A. SHIELDS,
[SEAL.] Clerk.

89

CIRCUIT COURT OF THE UNITED STATES,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs. } In Equity.
NATIONAL GRAMOPHONE CO. ET AL.

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Affidavit of C. A. L. Massie.

C. A. L. MASSIE, being duly sworn, deposes and says: I am of lawful age and reside in New York City. I am an attorney-at-law, and since the beginning of this year have been associated with Philip Mauro, Esq., Counsel for Complainant herein. 91

I am familiar with the recent litigation of Complainant herein, and was present at the final hearing before his Honor Judge SHIPMAN in this Court of the suit by Complainant against Leeds & Baldwin. I have this morning procured from A. Parker Smith, Esq., Counsel for Defendants in that case, an Echophone talking machine which bore, and still bears, a tag identifying the machine as one of Defendants' Exhibits in that case. I recognize this machine as one of those against which Judge SHIPMAN ordered an injunction to issue, and have marked it "A. G. Co. vs. National Gramophone Co. *et al.*, Complainant's Exhibit Echophone." 92

C. A. L. MASSIE.

Subscribed and sworn to before me, a Notary Public, this 10th day of Nov., 1898.

S. O. EDMONDS,
Notary Public, Kings Co.
Certificate filed in New York Co.

[SEAL.]

93

IN THE UNITED STATES CIRCUIT COURT.

SOUTHERN DISTRICT OF N. Y.

AMERICAN GRAPHOPHONE CO.

vs.

94 NATIONAL GRAMOPHONE CO. and FRANK SEAMAN.

In Equity.

Affidavit of S. T. Cameron.

DISTRICT OF COLUMBIA, ss.:

S. T. CAMERON, being first duly sworn, says:

95 I reside at Washington, D. C., am 41 years old and am by profession a lawyer, solicitor of patents and expert in patent causes.

I was for more than eight years an Examiner in the U. S. Patent Office, where it was a part of my daily duty to pass upon the patentability of devices for which patents were sought, and to investigate the state of the art bearing on such devices as the same might be disclosed in U. S. and foreign patents and in the literature of the arts.

96 Since my withdrawal from the Patent Office I have been continuously engaged in the practice of my profession, have prepared and prosecuted many applications for patent, and have repeatedly testified as expert witness in patent causes before the U. S. Courts. I am familiar with the construction and operation of talking machines, commonly called graphophones, phonographs or gramophones, and have frequently examined and operated such machines.

I am familiar with U. S. Letters Patent No. 341,214, granted to Chichester A. Bell and Sumner Tainter;

Raymond R. Wile Research Library

97 and U. S. Letters Patent No. 341,288 and 375,579, granted to said Tainter, and with the construction and operation of the devices described therein. I have recently given an expert deposition in the case of the American Graphophone Company vs. Cleveland Walcutt brought in this district for the infringement of Letters Patent No. 341,214 and 341,288 (the patents here in suit); and I have also given an expert deposition in the case of the American Graphophone Company vs. Walcutt and Leeds, likewise in this district, 98 as well as an expert affidavit in the case of the same Company vs. Walcutt and Leeds, Limited, also in this district.

The art of practically recording and reproducing sound consists in forming in a tablet of solid material a very fine undulatory line or groove whose undulations correspond to the sound waves which it is desired to record and reproduce, and then passing a rubbing style, attached to a suitable diaphragm over the undulations of the record groove, and thus causing the 99 vibrating diaphragm to create in the adjacent air sound waves similar to those originally recorded.

At the date of the Patents 341,214 and 341,288 in suit, there were two methods known to science of obtaining a record of the sound waves, though neither of said methods produced records which could be utilized in practical affairs for the reproduction of sound. The earliest of these methods was that of Leon Scott and was employed in what is known as the Scott Phonautograph. 100 It was obtained by coating a tablet with lamp black, and allowing a style carried by a suitable diaphragm supported at right angles to the surface of the tablet to rest against the tablet while the latter was revolved, and at the same time given translatory movement relative to the style. In the absence of sound the style traced a regular spiral line in the lamp black on the surface of the tablet, but when sound waves were caused to impinge upon the diaphragm the spiral line traced by the style in the lamp black was no longer a regular line, but an irregu-

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lar, sinuous line, the sinuosities of which were in a
plane parallel with the surface of the tablet, and corresponded
to the sound waves impinging upon the diaphragm.
This produced a visual sound record, but
could not be used to reproduce sound.

The second method was that invented by Mr. Edison
and embodied in his tin foil phonograph of 1878. A
cylinder having a spiral groove cut thereon was covered
with tin foil, and a style was supported by a dia-
102 phragm with its point resting on the tin foil immediately
over the spiral groove. In this case the vibrations
of the diaphragm were not parallel to the surface
of the cylinder as in Scott's phonautograph, but perpendicular
thereto, and when the cylinder was revolved
and given translatory motion relative to the diaphragm
and style, sound waves caused to impinge upon the diaphragm
vibrated the point of the style towards and from
the axis of the cylinder, causing it to indent the tin foil
and thereby trace an undulatory spiral line therein, the
103 undulations being normal to the surface of the cylinder
and corresponding to the sound waves impinging upon
the diaphragm. This method could be used to reproduce
sound, but not intelligible speech, and was chiefly
important as instrumental in demonsting the scientific
possibility of recording sound waves and reproducing
sound from the record.

In forming a sound record by either of the above
methods it was immaterial whether the tablet was in
the form of a disk or of a cylinder, as in either case
104 the record would be produced in the form of a spiral
groove on the surface of the tablet. In Patent
No. 341,214, in suit, the tablet is "shown as a
disk" (p. 3, line 27), while in patent No. 341,288 it is
shown as a cylinder. The groove of the sound record
is an exceedingly fine, almost microscopical line, and in
the patent No. 341,214, in suit, the reproducer is
freely or loosely mounted in order that the rubbing
style thereof may automatically track in the record.
To facilitate this automatic tracking of the reproducer
style in the groove of the record, the record groove is

105 made "in the form of a groove with sloping walls." This construction is defined in the following claims of said patent:

> 19. The combination, with a reproducing style of a mounting therefor, which leaves said style-face to move laterally, and thereby adjust itself automatically to a sound-record, substantially as described.
>
> 106 20. The reproducer loosely mounted on a suitable support, so that the reproducing-style is capable of a lateral movement, and may in consequence thereof adjust itself automatically on the record, substantially as described.
>
> 21. The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described.
>
> 22. The combination, with a grooved tablet or other body having a sound-record formed therein, of a reproducer having a rubbing style loosely mounted, so that it is free to move laterally, and thus adjust itself to the groove, substantially as described. 107
>
> 23. The combination, with the tablet or other body having the sound-record formed therein as an irregular groove with sloping walls, of a reproducer having a style for rubbing over said record and mounted on a universal joint, substantially as described.

108 I am familiar with the instrument marked "Complainant's Exhibit Defendants' Machine," and the records used in connection therewith, and have carefully examined and operated the same many times. It is an instrument for reproducing sound from a previously prepared sound record, and has a reproducer consisting of a metal head or frame carrying a diaphragm to which is attached a metal style. This reproducer is mounted on one end of a wooden arm, the other end of which is supported to

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turn on a horizontal pivot having bearing in the forks of a vertical pivot mounted to turn in a socket in the end of a rigid arm projecting outward from the base of the machine. Owing to the loose mounting on the horizontal pivot the free end of the wooden arm, and with it the reproducer mounted thereon, can rise and fall and the reproducer is therefore held against the record by gravity only. On the other hand the arm is free to move laterally about the vertical pivot of the forked 110 piece so that the reproducer, and including of course the style, has free lateral movement. I have placed the records furnished in connection with the gramophone under the microscope and I find that the record groove is an irregular groove with sloping walls, the walls of the groove being in the form of a V whose walls are slightly concave. The record marked "Complainant's Exhibit Defendants' Record" is one of those which I have examined, and has a record in the form of an irregular groove with sloping walls. This manner 111 of mounting the reproducer and its combination with the record came very clearly within the construction defined by claims 19, 20, 21, 22 and 23 of patent No. 341,214, which I have quoted above.

The specification of that patent says (lines. 84-104, p. 1 and 1-3, p. 2):

> "The invention consists, fourthly, in loosely mounting the reproducing-style so that it can be readily guided by the record. Preferably the 112 reproducing-style, or rather what may be called the 'head' of the reproducing instrument, is mounted on a universal joint, and the style is pressed against the record by the yielding pressure of a spring or weight. Practically in the instruments made by us the pressure is due to the weight of the instrument, modified by the elasticity of a section of soft rubber tube, which supports the same and constitutes a universal joint; but evidently there are many devices which can be used to mount the reproducer, so that it is free

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to follow the sound record, or phonogram, and which, therefore, would be within the spirit of the invention. The reproducing-style, mounted as just explained, is specially adapted for use in connection with a record in the form of a groove with sloping walls, and this combination is specially claimed; but it may also be usefully employed in connection with other forms of record."

114

And on page 2, lines 51 to 54, the specification says:

> "The invention consists, ninthly, in having the recorder, of whatever description, or the reproducer, or both, rest against the tablet or recording material by gravity."

I find it also stated in lines 44-47, page 6, that

> "It is evident that various modifications other than those indicated can be made and the invention still be employed in whole or in part, and also that parts of the invention may be used separately." 115

Upon comparing the instrument "Complainant's Exhibit Defendants' Machine" with these statements of invention in the Bell and Tainter patent, I find it to respond thereto with most remarkable exactness.

I find that in said machine "the reproducing style, or rather the 'head' of the reproducing instrument," is mounted on what is practically a universal joint, so that the style can "be readily guided by the record"; and that the "style is pressed against the record by the yielding pressure of a * * * weight"—*i. e.*, its own weight and that of its supporting arm. 116

I find that the reproducing style in defendants' instrument, by reason of its being mounted on a universal joint "so that it is free to follow the sound record or

117 phonogram," is "specially adapted for use in connection with a record in the form of a groove with sloping walls," and that in actual practice it is used with such a record.

I find that whether the reproducer is used with a record with "sloping" walls or not is immaterial, since the patent distinctly states that "it may also be usefully employed in connection with other forms of record." I find that the reproducer "rests against the
118 tablet or recording material by gravity."

I find that it is but one of those modifications which the Bell and Tainter patent says "can be made and the invention still employed in whole or in part."

In short, I find that it is but one of the many mechanical expressions which may be given to the inventive idea illustrated in the mounting and operation of the Bell and Tainter reproducer.

I find that the construction and operation of the instrument "Complainant's Exhibit Defendants' Ma-
119 chine" is exactly that of claims 19 and 20, which read as follows:

> 19. The combination, with a reproducing style, of a mounting therefor, which leaves said style-face to move laterally, and thereby adjust itself automatically to a sound record, substantially as described.
>
> 20. The reproducer loosely mounted on a suitable support, so that the reproducing style
> 120 is capable of a lateral movement, and may in consequence thereof adjust itself automatically on the record, substantially as described.

In the defendants' machine the reproducing style is combined with the pivoted wooden arm which constitutes a mounting, "which leaves the style free to move laterally, and thereby adjust itself automatically to a sound record," as stated in claim 19; I note that this claim 19 reads "which leaves said style-*face* to move

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laterally," but this is manifestly a misprint, as I have found by inspection of the original in the file wrapper in the Patent Office, which reads "style *free* to move laterally."

The reproducer in defendants' machine is also loosely mounted (through the medium of the pivoted wooden arm) on a suitable support, which is the rigid metal arm to which the wooden arm is pivoted, "so that the reproducing style is capable of a lateral movement, and may in consequence thereof adjust itself automatically on the record," as stated in claim 20. 122

Claim 21 defines the reproducer as mounted on a universal joint and held against the record by yielding pressure, and defendants' machine contains just this construction. The reproducer is carried by the wooden arm, which turns on a universal joint, and the reproducer rests on the record by yielding pressure—that is, gravity pressure—due to its own weight and that of the free end of the wooden arm, and in line 91 of page 1 the patent 341,214 defines "yielding pressure" as that of a "spring or weight." 123

Claim 22 is for the combination of a grooved tablet having a sound record formed therein, with a reproducer having a rubbing style loosely mounted so that it is free to move laterally and thereby adjust itself to the groove. As I have explained in connection with claims 19, 20 and 21, the reproducing style in defendants' machine is loosely mounted through the medium of the wooden arm with its universal joint, and in operation this style rubs over a groove formed in the record tablet. 124 Claim 23 is more specific than claim 22, in that it defines the record groove as "an irregular groove with sloping walls," and the reproducing style as "mounted on a universal joint." Defendant's machine responds to this specifically defined combination. I have repeatedly and carefully examined the record groove of the record marked "Complainant's Exhibit Defendants' Record," and I find that it is a tablet "having the said record formed therein as an

125 irregular groove with sloping walls." That the groove is "irregular" and has "sloping walls" I have determined by examination made under the microscope, and that said groove is a sound record I have demonstrated by placing it on "Complainant's Exhibit Defendants' Machine" and reproducing sound therefrom. I have explained in connection with claims 19, 20, 21 and 22 that the reproducer in defendants' machine, together with its style, is mounted on a universal joint. 126 When defendants' machine is in operation, we, therefore, have the combination defined in claim 23, that is, the tablet having the sound record formed therein as an irregular groove with sloping walls, combined with a reproducer having a style for rubbing over said record and mounted on a universal joint.

For the reasons given above I have no hesitation in stating that the constructions defined in claims 19, 20, 21, 22 and 23 of the Bell and Tainter patent 341,214 in suit are all combined in "Complainant's Exhibit 127 Defendants' Machine" when operating with a tablet of the character of "Complainant's Exhibit Defendants' Record."

I am familiar with the so-called Metaphone which is the machine held by His Honer Judge SHIPMAN to infringe claims 19, 20, 21, 22, 23 and 24 of the Bell and Tainter patent 341,214. In that machine the reproducing device consists of a reproducing point on one end of a glass tube, the other end of which is loosely mounted on the frame of the machine. The repro-128 ducing device of the gramophone, as the same is exemplified in "Complainant's Exhibit Defendants' Machine," is a more exact imitation of the construction defined in the Bell and Tainter patent 341,214 than that of the Metaphone, in that it has a style attached to a diaphragm supported in a "head" which is mounted on a universally jointed arm. This mounting of the reproducer arm is a free or universal one, so that it can swing laterally or in a horizontal plane at the same time that the reproducing point rises or falls

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to accommodate itself to any irregularities in the surface of the record disk, due to warping or other causes. In the gramophone, as in the metaphone, the reproducer is allowed to rest, with its free end carrying the reproducer point, on the record. As the record revolves, the reproducer swings laterally, being guided solely by the fine sound groove, and being kept in place by the sloping walls thereof.

SHELTON T. CAMERON.

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Subscribed and sworn to before me this 3d day of Nov., 1898.

HERBERT A. GILL,
[SEAL.] Notary Public.

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IN THE UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE CO.
vs.
134 NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.
In Equity.

Affidavit of Arthur S. Browne.

DISTRICT OF COLUMBIA, ss.:

ARTHUR S. BROWNE, being first duly sworn, deposes and says as follows:

135 1. I reside in Wasington, D. C.; am 37 years old, and am a patent solicitor and expert.

2. I have been a solicitor of patents for 16 years, and during the last eight years I have testified as an expert witness in more than sixty suits brought in the United States Circuit Courts for the infringement of patents.

3. I have been familiar with the Bell and Tainter Patent No. 341,214, dated May 4, 1886, here in suit and with the art of and means for recording and repro-
136 ducing sounds for several years. I have heretofore testified as an expert witness in six suits in the U. S. Courts in which the subject of talking machines has been involved, and in five of these suits the said Bell and Tainter Patent has been involved.

4. I testified as an expert witness for the complainant in the suit of American Graphophone Company vs. Leeds, White and Baldwin, in the U. S. Circuit Court for the Southern District of New York, decided June 18, 1898, and reported in 87 Fed. Rep., 873. For brevity I will refer to said suit as "Graphophone Co.

137 v. Leeds." In that suit the said Bell and Tainter patent was the patent sued on, and the principal claims of said patent involved were Nos. 19, 20, 21, 22, 23 and 24.

5. The defendants' structure involved in said suit of Graphophone Co. v. Leeds was a sound-reproducing instrument called the "Metaphone," by which name I will here identify it.

6. From my deposition in Graphophone Co. v. Leeds, describing the "Metaphone," I quote as follows: 138

"The reproducing device of defendants' machine consists of a reproducing point on one end of a glass tube, the other end of which is loosely mounted on the frame of the machine. When a sound record is on the mandrel the reproducing point rests by gravity upon the record and with a yielding pressure, which is rendered adjustable by means of the adjustable coiled spring. The mounting of the reproducer tube or hollow arm is a free or universal mounting, so that it 139 can swing laterally or in a longitudinal plane at the same time that the reproducing point rises and falls in following the sinuosities of the sound record. In operation, the reproducer is allowed to rest with its free end carrying the reproducer point on the record cylinder. As the record cylinder revolves the reproducer swings laterally, being guided solely by the fine sound groove, and being kept in place by the sloping walls thereof."

As here stated, the reproducing arm of the "Metaphone" is universally mounted so that it is free to swing laterally, and to rise and fall, a floating reproducer being thus formed. 140

7. In said suit, Graphophone Co. v. Leeds, I testified that the subject matter of claims 19, 20, 21, 22 and 23 *(inter alia)* of the Bell and Tainter patent No. 341,214 was embodied in the "Metaphone."

8. I am familiar with the talking machine called the "Gramophone," and have examined and am familiar with the construction, organization and mode of oper-

141 ation of "Complainant's Exhibit Defendants' Machine" and "Complainant's Exhibit Defendants' Record," which I will refer to as the "Gramophone" and "Gramophone Record" respectively, for the sake of brevity.

9. The Gramophone is a sound-reproducing instrument. When in condition for use its principal instru-
mentalities are (1) a flat disk having a sound record
formed therein as an irregular groove with sloping
142 walls, said groove being on the upper surface of the
disk and extending spirally; (2) means for rotating
said disk, and (3) a reproducer loosely mounted on a
suitable support, so that the reproducing point or style
carried by it is capable of moving laterally and also up
and down.

The reproducer is carried by an arm which is con-
nected to a suitable support by a gimbal or universal
joint, so as to freely swing both laterally and up and
down, so that the reproducer is a floating one. The
143 reproducing point or style rests by gravity in the sound
record groove of the sound record disk. Owing to the
loose mounting or floating character of the reproducer,
the reproducing point or style is free to follow the
irregularities of the sound groove when the sound disk
rotates. Owing to its capacity for rising and falling
due to the universal mounting or floating character of
the reproducer the style keeps in the sound groove
notwithstanding any departure from a true plane in the
surface of the sound disk, which is of almost universal
144 occurrence; and, owing to its capacity for lateral
movement due also to said universal mounting or float-
ing character the style automatically follows or
tracks in the spiral convolutions of the sound groove,
and also conforms to the sinuosities thereof.

By virtue of the style following the sinuosities of the sound groove it is set in vibration correspondingly, and these vibrations produce the phenomena of sound.

10. The Gramophone is substantially like the Metaphone in respect to its reproducing instrumentalities. In the Gramophone, as in the Metaphone, the repro-

145 ducing style rests by gravity in the sound groove of the sound record, and is carried at one end of a reproducer arm, which, at its other end, is connected with a suitable support by means of a universal joint. In both instruments the style is free to automatically rise and fall to compensate for any surface irregularities in the sound record, and the lateral swing of the reproducer arm permits the reproducing point or style to follow or track the spiral sound groove from beginning to end. In both instruments the swing of the reproducer arm 146 is due to the action of the sound groove upon the style, and as the record rotates the reproducer swings laterally, being guided solely by the fine sound groove, and being kept in place by the sloping walls thereof. The construction, organization and mode of operation of the reproducer, and its co-operative relation to the sound record, are the same in the Gramophone and in the Metaphone.

11. In said Graphophone Co. vs. Leeds suit I testified that the Metaphone embodied the subject matter of 147 claims 19, 20, 21, 22 and 23 of the Bell and Tainter patent No. 341,214, said claims relating to the universally mounted or floating reproducer and its relation to the sound record, and, owing to the substantial identity between the Metaphone and the Gramophone as far as these features are concerned, I am of the opinion that the subject matter of each of said claims is embodied in the Gramophone.

12. It is so obvious on reading each of said claims 19, 20 and 21 that its subject matter is embodied in 148 the Gramophone, and constitutes the means whereby it is enabled to operate, that no such explanation as experts are usually called upon to make in such connection is required to be made in the present case.

13. When the Gramophone is supplied with the Gramophone Record, having an irregular sound groove with sloping walls, it is equally obvious on reading claims 22 and 23 that the subject matter of each is then embodied in the Gramophone.

14. In expressing this opinion that the Gramophone

149 when equipped with the Gramophone Record embodies the subject matter of claims 22 and 23, I do not overlook the circumstance that the Gramophone Record is specifically different from the particular sound Record specifically described in the Bell and Taintor patent No. 341,214, and also from the particular sound Record used in the Metaphone, but this circumstance I regard as wholly immaterial as far as these claims are concerned. Claim 24 of the Bell and Taintor patent is
150 drawn to recite the specific sound record of the patent combined with the floating reproducer, and the subject matter of this claim 24 was also embodied in the Metaphone. The language of claims 22 and 23 does not recite the limitations of claim 24, with reference to the sound record, and it is obvious from the language of the descriptive portion of the patent that the patentees contemplated the employment, in connection with their floating reproducer, of other sound records than that specifically set
151 forth (see line 101, page 1, to line 3, page 2, and lines 43 to 55, page 6). All that claim 22 requires as to the sound record is, that there should be "a grooved tablet or other body having a sound record formed therein," and this definition aptly describes the Gramophone Record, and all that claim 23 requires as to the sound record is, that there should be a "tablet or other body having the sound record formed therein as an irregular groove with sloping walls," which correctly describes the Gramophone Record. The Gramo-
152 phone Record is that specified in each of the claims, and it has the same co-operative relation with the floating reproducer, which is characteristic of the sound record and reproducer of the Bell and Tainter patent No. 341,214.

ARTHUR S. BROWNE.

Sworn to and subscribed before me this 5th day of November, 1898.

S. G. HOPKINS,
N. P.

[SEAL.]

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FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
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Affidavit of Arthur J. Hall.

1. ARTHUR J. HALL, being sworn, says: I am forty years of age, reside at Washington, D. C., and am by profession a physican and expert microscopist.

2. I have been for more than eight years past engaged in the microscopical study of disease germs and other kindred subjects requiring the skillful use of the microscope, during which time I have mounted and studied under the microscope many hundred of minute objects. 155

3. I am familiar with the Berliner Gramophone sound record, entitled in this cause and marked "Complainant's Exhibit Defendants' Record," and have carefully and repeatedly examined the same with the microscope. I find such record to consist of a fine spiral groove formed in the surface of a tablet which is apparently composed of hard rubber. The groove is in the shape of a V, the walls thereof sloping downward from the top surface of the tablet to the bottom of the groove, the line of union at the bottom of the groove being slightly rounded rather than of a sharp V shape. This form of the groove can be seen by properly placing the record tablet under the microscope, but to be perfectly certain as to the shape of the groove I took an impression in wax of a portion of the 156

157 record surface, thereby obtaining the spirals of the groove and the ridges between the spirals *in reverse*, so that in the wax impression the counterpart of the groove appeared in the form of a ridge. I then prepared a cross-section of this wax impression, and upon placing said cross-section under the microscope the form of the *ridges* thereof, which corresponded exactly to the *grooves* of the record, could be clearly seen. I took several such wax impressions of different parts of

158 "Complainant's Exhibit Defendants' Record," and without exception I found that the walls of the groove sloped downward to a line of union at the bottom of the groove. I also observed that the groove was not an even, regular spiral, but was full of irregular sinuosities or wave-like undulations. From my studies of this record groove as above indicated, I can state that the same is an irregular groove with sloping walls.

ARTHUR J. HALL.

Subscribed and sworn to be-
159 fore me this 8th day of
November, 1898.

WILLIAM L. FORD,
[SEAL] Notary Public,
D. C.

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(No Model.) 4 Sheets—Sheet 2.

C. A. BELL & S. TAINTER.

RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

No. 341,214. Patented May 4, 1886.

Fig. 12

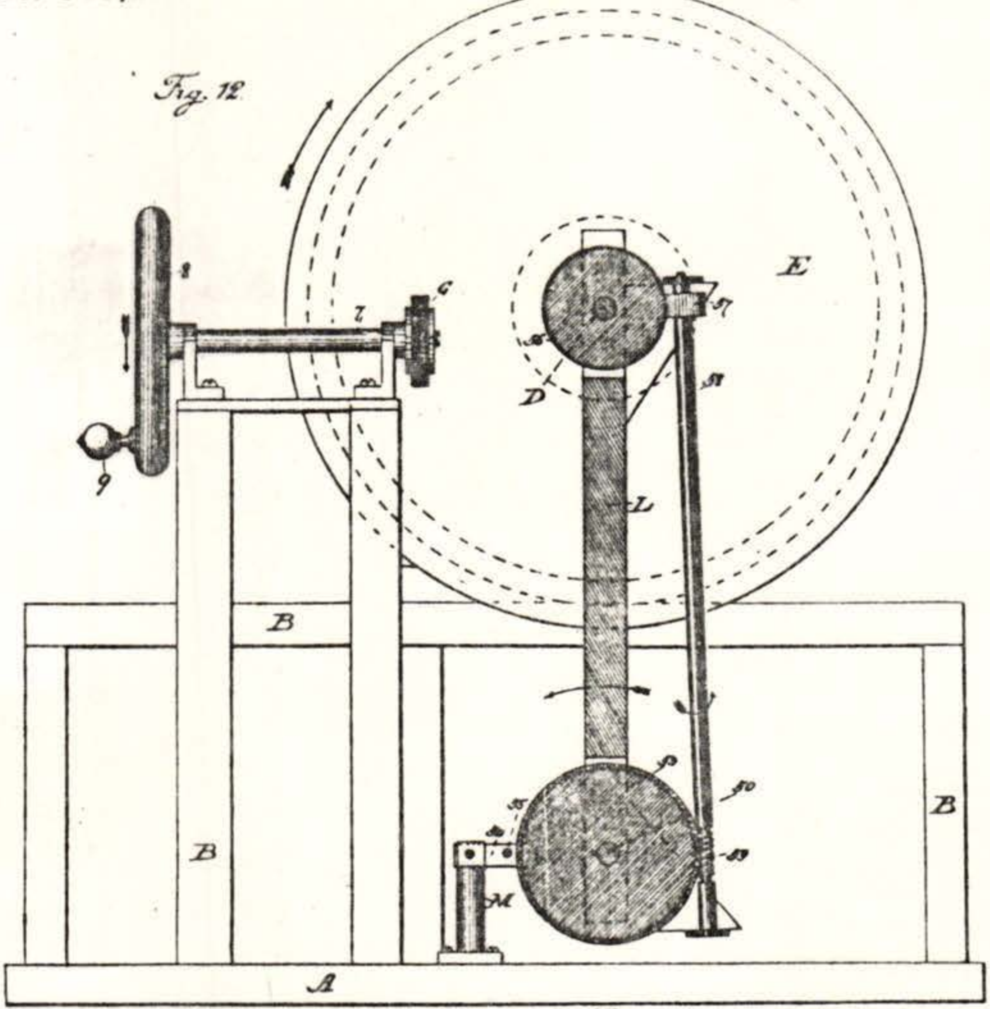
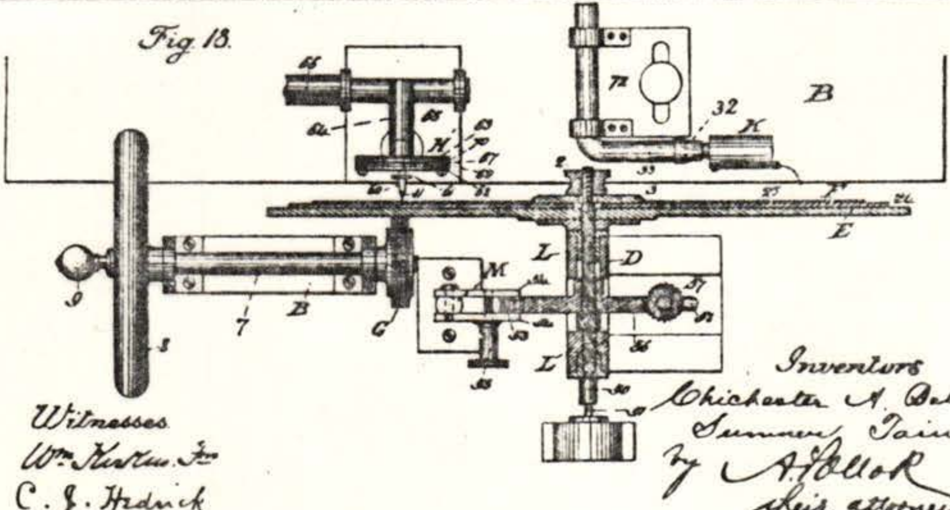


Fig. 13.



Witnesses

Wm. Kirkes Jr.

C. J. Hedrick

Inventors

Chichester A. Bell &

Sumner Tainter,

by A. Pollok

their attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 4 Sheets—Sheet 3

C. A. BELL & S. TAINTER.

RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

No. 341,214. Patented May 4, 1886.

Fig. 21.

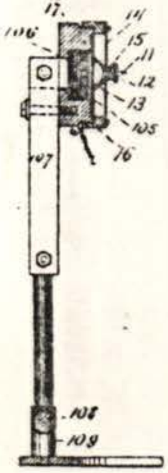


Fig 14.

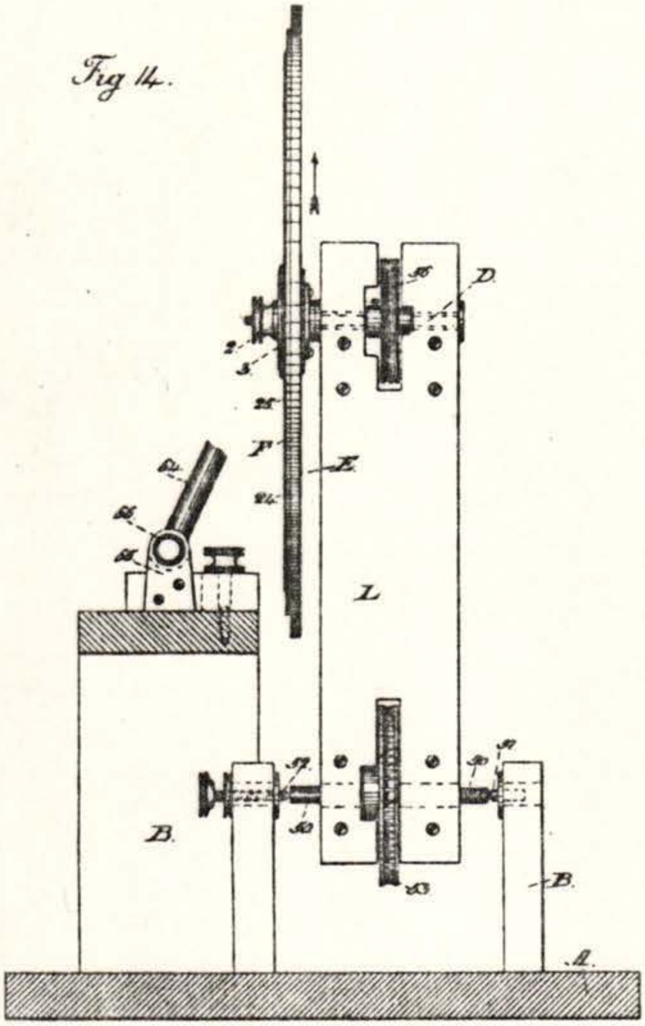


Fig. 15.

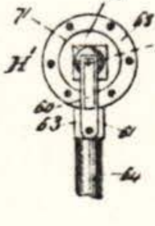


Fig 16.

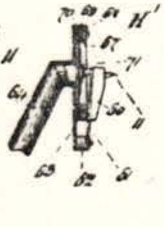
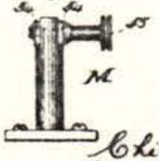


Fig 17.



Witnesses
Wm Kirkus Jr.
C. J. Hedrick

Inventor.
Chichester A. Bell
& Sumner Tainter
by A Pollok
their attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D.C.

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(No Model.) 4 Sheets—Sheet 4.

C. A. BELL & S. TAINTER.

RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

No. 341,214. Patented May 4, 1886.

Fig 18

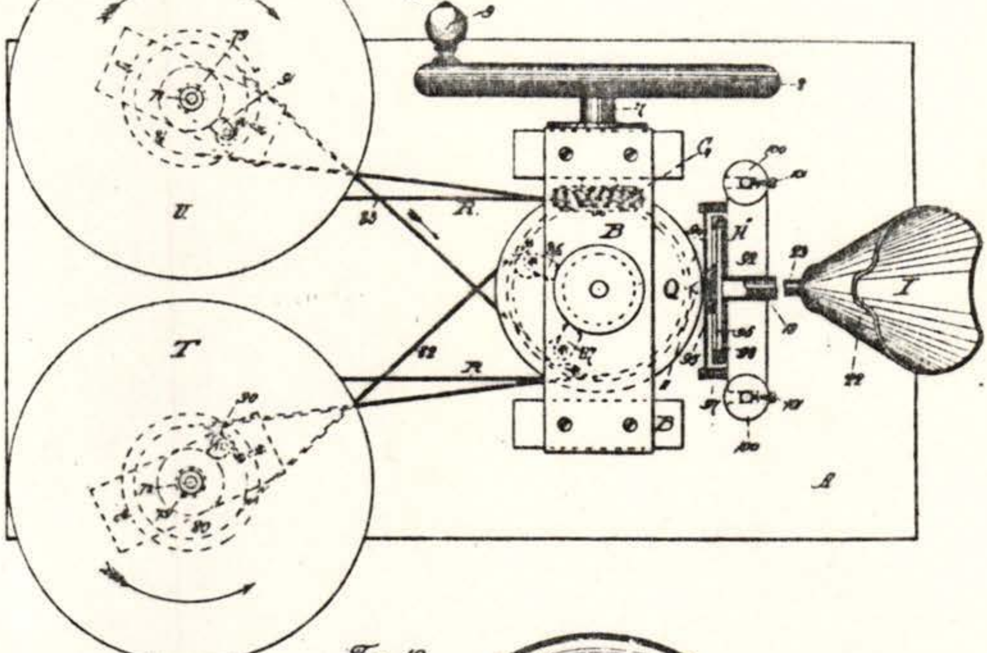


Fig 19.

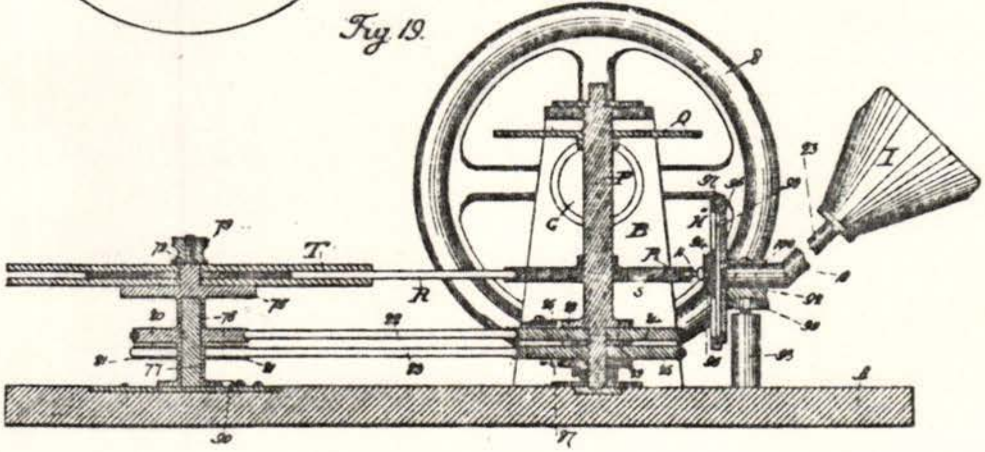
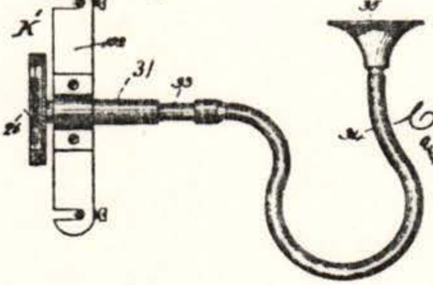


Fig. 20.



Witnesses.
Wm Kuker Jr
C. J. Hedrick

Inventors.
Chichester A. Bell
& Sumner Tainter
by A. Pollok
their attorney

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just as they had been doing before being sued and enjoined

CHICHESTER A. BELL AND SUMNER TAINTER, OF WASHINGTON, D. C.

RECORDING AND REPRODUCING SPEECH AND OTHER SOUNDS.

SPECIFICATION forming part of Letters Patent No. 341,214, dated May 4, 1886.

Application filed June 27, 1885. Serial No. 170,044. (No model.)

To all whom it may concern:

Be it known that we, CHICHESTER A. BELL and SUMNER TAINTER, both of Washington, in the District of Columbia, have invented a new and useful Improvement in Recording and Reproducing Speech and other Sounds, which improvement is fully set forth in the following specification.

This invention relates to the formation, in a solid substance, of elevations and depressions, or other inequalities corresponding more or less perfectly to the forms of sound-vibrations, and the reproduction, by means of such inequalities, of the sounds represented by them.

The invention consists, first, in the formation of the record or "phonogram," as it has been called, by means of a cutting-style which is vibrated by the sound-waves or sonorous vibrations to be recorded. The vibrations may be impressed upon the style directly by the impact of the sound-waves upon some device mechanically connected with or carried by the cutting-style or its support, or indirectly through the action of an electric current or other suitable vibratory medium. Heretofore a large number of contrivances have been devised for converting electrical impulses into mechanical vibrations, and they could, of course, be used for vibrating the cutting-style. Otherwise they have no relation to this part of the present invention, the essential new feature of which is the removal of material to form the record by a cutting, gouging, or graving action of the vibrating style. Heretofore the vibrating style has, as in Edison's well-known phonograph, simply indented the recording material. It has been proposed to cut the record in the edge of a strip of metal or other solid material by vibrating the strip in contact with the cutting-edge of a rotary disk-cutter; but this proposal is essentially different from this invention, the new mode being applicable to cutting the record upon all sorts of surfaces, and not upon strips only, and is, besides, believed to be later in time than this invention. Under this part of the invention are included the vibratory cutting-style as a new device in a sound-recorder, and the combination of the same with other devices; also the cut or engraved record itself. In this new or improved form of record not only may a larger number of words or sounds be recorded in a given surface than has been practicable with the indented records heretofore in use, but the recorded vibrations are also sharper and better defined. It is found that an indenting style smooths over the crests of the larger elevations, and also rubs out some of the finer ones.

The invention consists, secondly, in engraving or cutting the record in a waxy or amorphous and slightly cohesive substance. Preferably, a compound of beeswax and parafine (the latter in excess) is employed. This compound has no tendency to clog the style, but is readily removed thereby in chips or shavings. This part of the invention also consists in a recording material composed of a wax or waxy surface on a paper or pasteboard foundation. Heretofore it has been proposed to use soft paper saturated or coated with paraffine as the material for recording by the indenting method; but its use does not appear to have been successful, and an outer layer of tin-foil was therefore employed to receive the indentations.

The invention consists, thirdly, in cutting or engraving the record in the form of a groove with sloping walls, the sound-waves being represented by elevations and depressions at the bottom of the groove or otherwise. The advantage of this form of record is that it forms an efficient guide to the reproducing-style.

The invention consists, fourthly, in loosely mounting the reproducing-style so that it can readily be guided by the record. Preferably the reproducing-style, or rather what may be called the "head" of the reproducing-instrument, is mounted on a universal joint, and the style is pressed against the record by the yielding pressure of a spring or weight. Practically in the instruments made by us the pressure is due to the weight of the instrument, modified by the elasticity of a section of soft-rubber tube, which supports the same and constitutes a universal joint; but evidently there are many devices which can be used to mount the reproducer, so that it is free to follow the sound record or phonogram, and which, therefore, would be within the spirit of the invention. The reproducing-style, mounted as just explained, is specially adapted for use in connection with a record in the form of a groove with sloping walls, and this

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just as they had been doing before being sued and enjoined, and combination is specially claimed; but it may also be usefully employed in connection with other forms of record.

The invention consists, fifthly, in reproducing directly from the wax record. It is found that such a record has sufficient strength to withstand the rubbing action of the reproducing-style, so that a considerable number of reproductions can be obtained from it. The smoothness of the wax gives it a great advantage in this regard. So far as we are aware, no one has reproduced sounds from a wax record by rubbing a style or reproducer over it.

The invention consists, sixthly, in a reproducer or reproducing-instrument in which the reproducing-style, instead of being placed behind its support, projects at the point beyond the edge thereof. One practical advantage of this is that it enables the position of the style on the record or phonogram readily to be observed.

The invention consists, seventhly, in cutting the sound-record in a fusible material, (the waxy compound before referred to, for example,) and then melting the surface slightly, so as to remove any roughness left by the cutting-style. These roughnesses are altogether outside of the sound-vibrations, and give rise in reproducing to scraping noises, which interfere with the intelligibility of the sounds reproduced. These scraping noises are greater with some other modes of reproducing which we have devised, and which will form the subject of other patents, than they are with a rubbing style; but even with the latter the additional smoothness given to the surface by the partial fusion has some advantage.

The invention consists, eighthly, in a sound-recorder having a cutting or graving style which is held by elastic or yielding pressure against the surface on which the record is to be made. The object is to enable the vibratory graver or cutting style to ride over instead of plowing through any elevations on the recording-surface. The depth to which the point of the cutting-style is embedded in the record affects the amplitude of the style's vibration. By this improvement the depth is kept uniform, notwithstanding any slight unevenness of the recording-surface.

The invention consists, ninthly, in having the recorder, of whatever description, or the reproducer, or both, rest against the tablet or recording material by gravity.

The invention consists, tenthly, in combining with a sound-recorder or recording-instrument of any suitable description, and specially with one having a cutting-style, a tube or hollow standard on which the recorder is mounted, and through which the sound-waves are conveyed to the same. This part of the invention also consists in supporting this hollow standard on a hinge, and having a sound-conveying tube communicate with the interior thereof through the hinge. This part of the invention further consists in supporting the reproducer or reproducing-instrument on a hollow sound-conveying standard, the same as explained with respect to the recorder, and in similarly connecting the hollow standard of the reproducer with an exterior sound-conveying tube.

The invention consists, eleventhly, in combining with the recorder a mouth-piece so shaped as to include the nose of the user. It is found desirable to concentrate the sound-waves as much as possible upon the recording instrument or style, and if an ordinary mouth-piece be used the sound reproduced from the record is imperfect in the nasal elements, and sounds somewhat like the speech of a person with a cold in his head. By the use of the improved mouth-piece this disagreeable quality of the reproduced sound is avoided.

The invention consists, twelfthly, in a reproducer in which the sonorous vibrations impressed by the record upon the style are by the latter communicated to a block, plate, or other body of hard rubber, and through said body are transmitted to the air or to other vibratory medium. It is found that this material (hard rubber) gives much purer sounds than metal and other substances heretofore employed. It appears to absorb minute vibrations which give rise to scratching noises, and also to communicate sonorous vibrations without at the same time adding any foreign vibrations due to the movements of its own particles among themselves. The result is probably due to the high elasticity and the homogeneity of hard rubber.

The invention consists, thirteenthly, in combining with the disk of a recording and reproducing apparatus, in which the record is formed on the face of said disk in a volute or spiral by cutting or otherwise by any known or suitable means mechanism for giving to said disk a uniform surface-speed under the recorder. Heretofore when the record was formed on the face of a disk the latter has been given a uniform rotation, so that the same number of words were recorded in the outermost circles as in the smaller inner ones. By giving to the disk a uniform surface-speed under the recorder, or by making the times of each rotation inversely proportional to the distance of the recorder from the center of the disk, the record of any given word or sound will be of the same length at whatever part of the disk it may be, and in this way it is possible considerably to increase the number of words or sounds on a given area.

The invention further comprises certain special instructions, combinations, and arrangement of parts, as hereinafter set forth.

Having now explained the principle of the invention, the manner in which the same is or may be applied will now be explained with reference to the accompanying drawings, which make part of this specification.

Figure 1 is a plan view of an apparatus constructed in accordance with the invention, arranged for recording; Figs. 2 and 3, respectively, a front elevation and cross-section of the same; Fig. 4, a view in section and elevation of the recorder; Figs. 5 and 6, views on an enlarged scale of the graver or cutting style; Figs. 7 and 8, views in elevation and section, respectively, of the reproducer; Figs. 9 and 10, similar views of another form of reproducer, and Fig. 11 an elevation of the sound-conveying tube for use with the reproducer. Figs. 12 to 17 represent a modified form of apparatus, Fig. 12 being a back view, partly in section; Fig. 13, a plan, partly in section; Fig. 14, an edge view, partly in section; Figs. 15 and 16, views in elevation and section of the recorder, and Fig. 17 an edge view of a friction-clamp making part of the apparatus. Figs. 18 and 19 are plan and longitudinal sections, respectively, of a form of apparatus also constructed in accordance with the invention, or with parts thereof in which the record is made on a strip, and Fig. 20 a plan, partly in section, of the reproducer for use with such apparatus. Fig. 21 is a view of a recorder in which the style is operated electrically.

Referring to Figs. 1 to 11, A is the base or bed of the apparatus, and B an upright frame, which carries the mechanism for supporting and moving the tablet F, (shown as a disk,) on which the record is to be or has been formed. In the slide C, movable in ways of the frame B, is journaled an arbor, D, on which are fixed a metal disk, E, at one end and a bevel-gear, 1, at the other. The arbor projects beyond the metal disk E, so as to form a support for the recording-tablet F, which is retained thereon by the nut 2 and washer 3. The metal disk E performs the double function of a friction-wheel and of a backing to the recording-tablet F. The bevel-gear 1 engages a similar gear, 4, on the end of the screw 5, which is journaled in a bearing in the slide C, and is tapped through a stationary lug, 6, on the frame B. As the arbor D is revolved, the screw 5 is turned also, and in consequence of its engagement with the lug 6 it moves the slide C lengthwise of the frame B. The rotation is communicated to the arbor from the shaft 7, journaled in bearings of the frame B, and provided at one end with a fly-wheel, 8, and crank-handle 9, and at the other with a friction-pinion, G. This pinion is formed, as shown, of rubber disks clamped together between metal washers. It bears against the back of metal disk E, and communicates motion to it. As the slide C is moved by the action of the screw 5, the metal disk E is carried past the friction-pinion, so that it touches the metal disk in a spiral line, and serves to give a uniform surface-speed to each part of the disk as it in turn comes opposite said pinion. The recorder H is placed on the opposite side of the metal disk E, preferably as shown, with the point of the graver or cutting style 11 directly opposite the point where the pinion G touches the disk E. The said pinion thus acts as a support to the disk against the action of the cutting or recording style. The latter is preferably formed of a round wire by turning the end conical and rounding the extremity, and then grinding off one side to the axis of the wire. This leaves sharp cutting-edges on both sides of the tapering point. These edges remove the material in chips or shavings, like a plane or turning-tool. It is not essential to give this form to the style. Any form which will remove the material and not simply displace it will answer. The style is set in one end of a block, 12, provided on the opposite end with a cup, 13, (see Fig. 4,) and secured in the cross-piece 14 by the nut 15. The cross-piece 14 is fastened to a ring, 16, into which a back plate, 17, is secured. These parts, except the steel style, are preferably of hard rubber, although they could be made of another material—of brass, for example. A sound-conveying tube, 18, is screwed into the back plate, 17, the end being just behind the cup 13. A diaphragm, 105, of any suitable material, whose edges are clamped between the ring 16 and back plate, 17, is placed behind the cup 13, which is pressed against said diaphragm by the elasticity of cross-piece 14. The cup 13 and block 12 serve to communicate the vibrations from the diaphragm to the recording-style.

The tube 18 forms part of a hollow standard, upon which the recorder is mounted. The lower part, 19, of this standard is hinged in the bracket 20, as clearly shown in Fig. 2, so that it can be rocked to bring the recorder into or put it out of action.

On the tube or standard 19 is a ring-weight, Z, which is retained in position by a set-screw, 127. It therefore can be adjusted up or down, in order to increase or diminish the pressure of the style 11 against the tablet F. The use of this weight is desirable, but not necessary.

The tube 21 communicates with the interior of the hollow standard through the hinge, and does not therefore interfere with its freedom of motion. This tube 21 can be fixed in the bracket or can be allowed to turn, as may be preferred.

The mouth-piece I is shaped to fit the face of the user, and is provided with a notch, 22, to receive the nose. It is attached to the tube 23, which at its lower end fits snugly in the tube 21 and communicates through the series of tubes 23, 21, 19, and 18 with the space inside and back of the cup 13.

In operation the recorder rests by its own weight, assisted by the pressure of weight Z, or by its own weight alone, if preferred, against the recording-tablet F, said weight causing the style to embed itself to the proper extent in the recording material. The sonorous vibrations impressed upon the style are so rapid, as well as so minute, that the record is made as perfectly as if the recorder were held positively, while at the same time the recorder can be moved bodily to conform to the unevenness of the surface of the tablet, and thus keep uniform the depth at which the style operates.

The tablet F consists of a paper or pasteboard foundation, 24, with a coating, 25, of

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just as th had been doing before being sued and enjoined, and wax. A composition excellently adapted to the purpose, and according to our experience the best, consists of one part, by weight, of white beeswax and two parts of paraffine. The two bodies are melted together, and if not perfectly free from dirt and grit should be filtered. A filtration through cotton-wool will answer. The coating is or may be about one-twentieth of an inch in thickness, (the paper being one-tenth of an inch, more or less,) and can be made by flowing the melted composition over the paper disk or foundation. The surface is preferably turned off flat on a lathe.

In order to place the tablet in the machine, the recorder H is turned back out of the way. When the tablet has been secured in place, the recorder is turned forward into the position shown, the style resting against and slightly penetrating the wax coating. A penetration of one one-hundredth of an inch has been found very effective, the style being formed of No. 16 wire shaped at the cutting end as in Figs. 5 and 6. Upon turning the fly-wheel 8 the disk E and tablet F will be turned, and the style 11 will cut or engrave a spiral line in the wax coating of the tablet. If one talks into the mouth-piece I, the style will be thrown into vibrations corresponding to the spoken words, and the engraved line will be of varying character, the inequalities or variations from uniformity representing the forms of the sound-waves.

The reproducer K, (shown in Figs. 7 and 8,) for reproducing from the engraved tablet or from other suitable record the sounds which formed said records, has a reproducing-style, 26, formed of a narrow metal strip bent near the end, as shown in Fig. 8, and pointed, as shown in Fig. 7. This style is held by cementing, riveting, or otherwise, between the strip 27 and the circular plate 28, both preferably of hard rubber. The strip 27 is fastened at the bottom to an offset on the block 29, in which a passage is formed for the sound-waves. This passage terminates just behind the plate 28. There is a fixed disk, 30, of the same size as the movable plate 28. It is cemented or otherwise fastened on the face of the block, and is perforated at the center, in order not to obstruct the opening therein. The plate 28 is close to but not in contact with the disk. The tube 31, fixed at the upper end to the block 29, is joined at the lower end to the tube 33 by a section of soft flexible vulcanized-rubber tubing, 32. For use the tube 33 is slipped into the tube 19 in the manner shown for the tube 18 of the recorder.

The reproducer K when so placed is mounted upon a hollow standard composed of the tubes or tubing 31, 32, 33, and 19, and in consequence of the flexibility of the rubber tubing 32 it is free to follow the record. No special care is necessary to insure its adjustment, for if the reproducer K be allowed to rest against the record with the style upon the engraved line the style will of itself gravitate to the bottom of the groove.

There exists always a liability to disarrangement in some part of the machine either in the recorder or the support therefor or the recording-tablet or its support, or if there be no disarrangement it would be difficult to insure that the reproducing-style should touch the record precisely at the proper point if the reproducer be held rigidly. Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the record. It will be seen that the reproducer is mounted on a universal joint, so that it can move in any direction. The movement parallel with the face of the tablet would, however, by itself allow the style to follow and adjust itself to the record to a useful extent.

In operation the reproducer K is placed against the record, and on turning the wheel 8 in the same direction and at about the same speed that it was turned in recording, the record will move the style 26 and plate 28, so as to throw the air in the hollow standard into vibrations, and produce sound-waves similar to those which originally acted upon the recording-style to make the record. The reproduced sounds are audible by placing the ear in proximity to the mouth-piece I; but it is preferred to withdraw said mouth-piece, and to connect the flexible tube 34 (see Fig. 11) with the tube 21 and listen at the ear-piece 35. After the record has been cut it will of course be understood that the machine is turned back to the starting-point for reproducing. The surface of the cut record can be rendered more smooth by removing the engraved tablet from the machine and exposing the surface to heat—as, for example, by rotating the tablet face downward over an alcohol-lamp until the surface begins to glisten. Of course a too long exposure would destroy the record. It is the merest surface action that is required. The record can be used for reproducing without submitting it to this operation and without removing it from the machine. It may, however, be removed, and at any time thereafter replaced on the same or a similar machine, and be made to reproduce the original sounds.

The reproducer K' (shown in Figs. 9 and 10) has the style 26 attached to the outer of two light plates, 36 and 37, which are attached to a diaphragm, 38, of thin sheet rubber clamped at the edges between the ring 39 and the border of the back plate, 40. The tube 31 is fastened in the back plate.

It will be observed that in both forms of reproducer the style 26 projects beyond the edge or end of the instrument, so that the position of its point on the record can be easily seen.

Referring now to Figs. 12 to 17, A is the bed, B an upright frame, D an arbor, E a metal disk, F the tablet, and G a friction-pinion, as in Figs. 1 to 11. The nut 2 and washer 3, the shaft 7, wheel 8, and crank 9, and the paper disk 24 and wax coating 25 are identical with the parts similarly numbered in Figs. 1, 2, and 3. The arbor D, instead of being journaled in a slide, is carried by an arm, L, which is supported by and is fixed on the short shaft 50. This shaft is supported on centers 51 and 52, so that the arm L can be rocked. The worm-wheel 53, loosely mounted on the shaft 50, is held stationary by the clamp M, the jaws 54 fitting on either side of the wheel, and being pressed against it by the thumb-screw 55. The arbor D carries a screw-wheel, 56, which engages the worm-pinion 57 at the upper end of shaft 58. The screw 59 at the lower end of the shaft engages the worm-wheel 53. This shaft 58 and the gears 57 and 59 carried thereby prevent the arm L being turned independently of the worm-wheel 53, except as the said shaft is rotated. As the arbor D, disk E, and tablet F are rotated, the screw 56 turns the shaft 58, and consequently—the worm-wheel 53 being held stationary by the clamp M—the arm L is swung gradually to one side, so that the recorder engraves a spiral line on the wax face of the tablet. When the record has been cut, it is only necessary, in order to restore the tablet to the starting-point for reproducing, to draw back the recorder and to loosen clamp M, when arm L can be moved at once to the proper position.

A recorder constructed and mounted precisely as in Figs. 1, 2, 3, and 4 could be used in this machine; but, as shown, the recording-instrument H′ is modified to some extent. The cutting-style 11 (which is the same as that of Figs. 4 to 6) is set into a block, 60, carried by a metal strip, 61. This is fastened to a block, 62, at the lower end of a back piece, 63, which is attached to the upper end of the tube 64, which forms the hollow standard for the recorder, and which is mounted on the bracket 65, so as to be capable of being turned to put the record into or out of action. The sound-conveying tube 66 corresponding to tube 21 of Figs. 1 and 2 communicates through the hinge with the interior of the tube 64. In front of the opening at the upper end of tube 64 is stretched a diaphragm, 67, of thin sheet metal, or it may be of other membrane or material, its edges being clamped between the ring 68 and back piece, 63, soft-rubber rings 69 and 70 being interposed one on each side of the diaphragm. On the opposite side of the diaphragm 67 from the tube 64 a light plate, 71, of metal cupped in the center, is held against the diaphragm by the pressure of the strip 61, a projection on the back of said strip bearing against the said plate 71.

In this machine the reproducer K, instead of being mounted on the same bracket as the recorder when the latter has been removed, is carried by a separate bracket, 72, the tube 33 being hinged thereto, so that the recorder and reproducer remain, or may remain, always attached to the machine, it only being necessary to turn one or the other into position, as may be required.

Referring to Figs. 18 to 20, A is the base or bed, B an upright frame, 7 the driving-shaft, 8 the fly-wheel, 9 the operating-crank handle, and G the friction-pinion, as in Figs. 1 and 2. The arbor P is supported in an upright position in bearings of the frame A B, and is revolved by the friction-pinion G engaging the friction-disk Q. The record is made on a wax-coated strip, R, of paper, which is passed around the periphery of the disk S in the groove formed thereon. As the strip passes in front of the recorder or reproducer, it is wound off one reel—say the reel T—and upon the other reel, U. The strip can be wound back upon the reel T when desired. Each reel rests by its own weight upon a platform or flange, 75, at the upper end of a hollow shaft, 76, which turns upon a stud, 77, fastened at the base to the bed B. A pin, 78, passes through the center of the reel, and forms a journal for it to turn upon. A nut, 79, holds the reel on, and may be used to bind it with more or less tension. On each shaft 76 is a belt-pulley, 80 and 81, respectively, driven by a crossed belt, 82 or 83, from a pulley, 84 and 85, on the arbor P. These pulleys 84 and 85 are loose upon the arbor, but are provided each with a clutch, 86 and 87, so placed (see Fig. 18) that when the arbor is turned to the left the clutch 87 engages the hub 89 on the arbor, and the pulley 85 is turned therewith, while when turned to the right the clutch 86 engages the hub 88. Each shaft 76 has a stop-clutch, 90 and 91, respectively, which holds it stationary when the strip is being wound on the other reel. Thus, when the arbor P is turned to the left the reel U is revolved in the direction indicated by the arrow, and the sleeve-supporting reel T is held stationary. The strip is thus stretched at all times, the degree of tension depending upon the friction between the reels and their supporting-flanges 75. The recorder H″ is carried by a cross-piece, 92, supported by posts 93. The style 11 is carried by a cross-piece, 94, to which it is attached by means of the cup 95, of hard rubber, which forms a nut on the screw-threaded shank of the style, and said cup rests against a mica diaphragm, 96, whose edges are clamped between the screw-ring 97 and the back plate, 98. The tube 18, screwed into the back plate, is fastened by soldering or otherwise to the cross-piece 92. The tube 23 of the mouth-piece I fits into said tube 18. The ends of the cross-piece 92 are slotted to fit around the screws at the top of posts 93 and rest upon nuts 99, and are clamped by nuts 100. By means of these nuts the vertical position of the recorder can be adjusted. After one line has been engraved on the strip, the recorder can be adjusted to engrave as many additional lines parallel thereto as the strip will receive. The slots in the cross-piece 92 allow the recorder to be moved toward and away from the strip, so as to regulate the depth of the engraved line. To insure a greater nicety of adjustment, screws 101 are

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just as they [illegible] been doing before being [illegible] tapped through the metal at the closed end of the slots, and bear at the point against the supporting-screws.

The reproducer K', Fig. 20, is similar to that shown in Figs. 9 and 10, except that the style 26 is so placed that the point is at the center instead of projecting beyond the edge of the instrument. Its position on the record is therefore not so readily seen; but with the form of machine shown in these figures this is less important. The same may be said of the loose mounting of the reproducer, although in point of fact the thin rubber diaphragm 38 gives a certain lateral play to the style. The tube 31 is rigidly fastened to a cross-piece, 102, identical with the cross-piece 92, and with said tube 31 the bearing-tube 30 and ear-piece 35 are connected.

The paper strip can be easily coated with the beeswax and paraffine compound by running the same through a body of melted composition and scraping one side, leaving what adheres to the other to harden thereon.

In Fig. 21 an arrangement for operating the recorder by electro-magnetism is shown. The magnet 107 is mounted on a bar, 108, journaled in bearings in standards 103. It is provided with a bobbin, 106, of wire, surrounding the pole-piece, which bobbin is included in a circuit over which electrical undulations are caused to pass by any suitable transmitting-instrument—for example, such as commonly employed on telephone-lines. In front of the pole-piece or core of the bobbin is a diaphragm, 105, of magnetic material, whose edges are clamped between the ring 16 and back plate 17. The cup 13 should always be in contact with diaphragm 105, and is pressed against it by the spring of piece 14. This cup, as well as the style 11, block 12, nut 15, and cross-piece 14, is the same as in the recorder H of Figs. 1 and 4.

It is evident that various modifications other than those indicated can be made and the invention still be employed in whole or in part, and also that parts of the invention may be used separately.

In the foregoing description details have been given with some minuteness. This has been done to furnish the best information in our power for enabling those skilled in the art to make and use the invention, and not with the intention of limiting the invention to the precise dimensions, proportions, shapes, and materials stated.

A means has been shown for impressing vibrations upon the recording-style by an electrical current through the intermediary of an electro-magnet, in a manner similar to that in which the diaphragm of an ordinary receiving-telephone has been vibrated.

It is evident that other means heretofore used for vibrating a diaphragm could be used in place of the magnet; also, it is evident that the vibrations of the reproducing-style could be taken up and transmitted by the means heretofore used for taking up and transmitting vibrations, (those of a telephone-diaphragm, for example.)

The term "cutting" is herein employed to indicate an action in which the material is removed in chips, shavings, or other small pieces—as in engraving, turning, and the like—and not simply displaced.

The displacement of the material is not only a different operation from the cutting contemplated by this invention, but is not calculated to accomplish the objects for which cutting or graving is employed.

Having now fully described our said invention and the manner in which the same is or may be carried into effect, what we claim is—

1. The method of forming a record of sounds by impressing sonorous vibrations upon a style, and thereby cutting in a solid body the record corresponding in form to the sound-waves, in contradistinction to the formation of sound-records by indenting a foil with a vibratory style, or cutting a strip by vibrating it against a revolving disk-cutter, substantially as described.

2. The method of forming a sound-record by impressing the sonorous vibrations upon a style in a direction at right angles to the recording-surface, and thereby cutting in a solid body a series of elevations and depressions of varying depth, corresponding in form to the sound-waves, substantially as described.

3. The vibratory cutting-style of a sound-recorder, substantially as described.

4. The cutting-style, in combination with a support permitting the same to be vibrated, and means for impressing sonorous vibrations thereon, substantially as described.

5. A vibratory cutting-style, in combination with a sound-conveying tube for concentrating the sound-waves upon the style, substantially as described.

6. A vibratory cutting-style, in combination with a tablet or other solid body in which the record is to be cut, and mechanism for supporting the same and moving it with reference to the said style, substantially as described.

7. A sound-record consisting of a tablet or other solid body having its surface cut or engraved with narrow lines of irregular or varied form corresponding to sound-waves, substantially as described.

8. A sound-record consisting of a tablet or solid body having its surface cut or engraved with a number of lines of variable cross-section, the irregularities or variations corresponding in form to sound-waves, substantially as described.

9. The method of forming a sound or speech record which consists in engraving or cutting the same in wax or a wax-like composition, substantially as described.

10. The sound or speech record cut or engraved in wax or a wax-like composition, substantially as described.

11. The recording-tablet of a phonograph or sound-recording machine, having as the material for recording sounds or sonorous vibra-

tions the composition of beeswax and paraffine, substantially as described.

12. The sound or speech record cut or engraved in a wax-like composition, such as the compound of beeswax and paraffine, substantially as described.

13. A tablet or body for recording sound-vibrations, consisting of a paper or pasteboard foundation and a surface-coating of beeswax and paraffine compound, substantially as described.

14. The sound or speech record cut or engraved in a wax-like composition, such as the described compound of beeswax and paraffine, constituting a surface-coating to a paper or pasteboard foundation, substantially as described.

15. The method of making a sound or speech record which consists in engraving or cutting in the recording material an irregular groove with sloping walls, the shape of the groove representing the sound-vibrations, substantially as described.

16. The method of making a sound or speech record which consists in cutting in the recording material a groove with sloping walls and of variable cross-section, the variations corresponding in form to sound-waves, substantially as described.

17. The sound-record in the form of an irregular groove with sloping walls cut in solid material, substantially as described.

18. The sound-record cut in wax or wax-like composition in the form of an irregular groove with sloping walls, substantially as described.

19. The combination, with a reproducing-style, of a mounting therefor, which leaves said style-face to move laterally, and thereby adjust itself automatically to a sound-record, substantially as described.

20. The reproducer loosely mounted on a suitable support, so that the reproducing-style is capable of a lateral movement, and may in consequence thereof adjust itself automatically on the record, substantially as described.

21. The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described.

22. The combination, with a grooved tablet or other body having a sound-record formed therein, of a reproducer having a rubbing-style loosely mounted, so that it is free to move laterally, and thus adjust itself to the groove, substantially as described.

23. The combination, with the tablet or other body having the sound record formed therein as an irregular groove with sloping walls, of a reproducer having a style for rubbing over said record and mounted on a universal joint, substantially as described.

24. The combination, with a sound-record formed in wax or a wax-like material, of a reproducer having a rubbing style for receiving sonorous vibrations from said record, substantially as described.

25. A reproducer having a style projecting beyond the edge or end of the instrument, so that the position of the point of the style on the record may readily be seen, substantially as described.

26. In a reproducer, the combination, with a vibratory plate or diaphragm, of a reproducing-style fastened flatwise on said plate or diaphragm and bent at the end, substantially as described.

27. The method of recording and reproducing sounds by cutting the record in a wax or wax-like material, and then rubbing over the record the style of a suitable reproducing-instrument, so as to impress sonorous vibrations on said style, substantially as described.

28. The method of improving a sound-record which consists in producing an incipient fusion of the surface, substantially as described.

29. The improvement in preparing a sound-record, consisting in cutting the record in a fusible material, and then producing an incipient fusion of the surface, substantially as described.

30. The sound-recorder having a vibratory cutting-style held against the recording material by yielding pressure, substantially as described.

31. The recording instrument having a vibratory cutting-style and mounted on a hinged arm, substantially as described.

32. The combination, with the tablet or body in which the sound-record is to be made, of the recording-instrument mounted on a hinged arm and resting by gravity against the tablet, substantially as described.

33. The recorder mounted on a hollow arm or standard, which constitutes also a sound-conveyer, substantially as described.

34. The recorder mounted upon an arm or standard hinged to its bracket or base, and provided with a sound-conveyer extending lengthwise of said arm, substantially as described.

35. The recorder mounted upon a hinged arm, and combined with a sound-conveyer which extends lengthwise of the arm, and is connected at the hinge with an exterior sound-conveyer, substantially as described.

36. The reproducer mounted upon a hollow standard which forms a sound-conveyer, substantially as described.

37. The reproducer mounted on a hinged arm, and provided with a sound-conveyer extending lengthwise of said arm, substantially as described.

38. The reproducer mounted on a hinged arm, and provided with a sound-conveyer extending lengthwise of said arm, and connected at the hinge with an exterior sound-conveyer, substantially as described.

39. The combination, with a sound-recorder, of a mouth-piece shaped to surround the mouth and nose of the user, and to concentrate the sound upon the recording devices, substantially as described.

40. The combination, with the tablet, in the

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form of a disk, and a recorder or reproducer, of mechanism for causing a spiral line to be traced on the disk by the recorder or reproducer at a uniform surface-speed, substantially as described.

41. The combination, with the tablet, in the form of a disk, the arbor, and the metal disk operating as a friction-wheel, of the slide, or its equivalent, such as herein shown, in which said arbor is journaled, and the friction-pinion for revolving said disk, substantially as described.

42. The combination, with the recorder or the reproducer, the disk, the arbor, and the laterally-movable support to the arbor, of the friction-pinion placed behind and bearing against the disk at a point opposite the recorder or reproducer, substantially as described.

43. The combination, with a recording-style and the support therefor, of a cup on the back of said support, and the sound-conveying tube terminating just behind the cup, substantially as described.

44. In combination with the style of a sound-reproducer, a vibratory body or plate of hard rubber, upon which vibrations are impressed by said style, and through which they are transmitted, substantially as described.

45. A tablet provided with a wax or wax-like coating, and having engraved in said coating a spiral line with inequalities or irregularities corresponding in form to sound-waves, substantially as described.

46. A tablet provided with a coating of wax or wax-like composition, and having a sound-record engraved in said coating, said engraved coating having the glazed surface which results from an incipient fusion of the wax after cutting or engraving the record, substantially as described.

47. In combination with a sound-recorder, a flaring mouth-piece shaped to fit over the face of the user and to include his nose, and communicating through a tube or contracted opening with the space behind the diaphragm of said recorder, substantially as described.

In testimony whereof we have signed this specification in presence of two subscribing witnesses.

CHICHESTER A. BELL.
SUMNER TAINTER.

Witnesses:
PHILIP MAURO,
C. J. HEDRICK.

UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY & FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF ORVILLE D. LA DOW.

COUNTY AND STATE OF NEW YORK, ss:

Orville D. La Dow, being duly sworn, deposes and says:

That he is a citizen of the United States, residing at Yonkers, in the State of New York, and doing business in the city of New York, and that he is the president of the National Gramophone Company, a corporation organized and existing under the laws of the State of New York, one of the above-recited defendants.

AND DEPONENT AVERS that the defendant corporation buys of Frank Seaman, a citizen of the United States residing at Yonkers, New York, the other above-recited defendant, gramophone machines and records made in accordance with certain patents of Emile Berliner, and sells them through a large number of agents to the public.

DEPONENT FURTHER AVERS that this business as conducted by the National Gramophone Company amounted to many thousands of dollars in the year 1896, that it amounted to several hundred thousand dollars in the year 1897, and that the public during the year 1898 has been paying for Gramophone machinery bought from the agents of the

National Gramophone Company at a rate approximating three-quarters of a million dollars a year.

DEPONENT FURTHERMORE AVERS that nearly two years ago over three hundred agents of the National Gramophone Company were engaged in selling Gramophone machinery to the public, and that at the present time over one thousand such agents are thus engaged, such agents being distributed throughout the United States and being found in every important town and city of the United States.

DEPONENT FURTHERMORE AVERS that the price of the standard Gramophone reproducing machine, as sold to the public, has been kept uniform at twenty-five dollars, and that despite the fact that the American Graphophone Company has been putting out Graphophone machines at a considerably less price, namely, ten dollars each to the consumer, yet the manifest superiority of the Gramophone for amusement purposes has been such that their sale has steadily increased, despite this competition of cheaper machines.

DEPONENT FURTHERMORE AVERS that the Gramophone machine, as sold by the National Gramophone Company, fills a want for amusement purposes which is not filled by any other machine on the market, and that this is true by reason of the fact that the volume of sound produced by such a gramophone is several times as large as the volume of sound produced by any other known form of speech reproducer. This feature, therefore, naturally makes the Gramophone peculiarly adapted for amusement purposes in rooms or halls containing more than one or two people. Furthermore, the indestructible character of the hard rubber record permits the Gramophone to go into the hands of the general public and of unskilled users, which is not true to the same extent of other records now on the market.

DEPONENT FURTHERMORE AVERS that the business of the National Gramophone Company, with its thousand agents and its hundreds of thousands of dollars of capital, would be irreparably injured if it were temporarily enjoined, so much so that it is doubtful whether it could ever again be reconstructed, and this, in deponent's opinion, without any corresponding benefit to the American Graphophone Company, whose machines could not replace those sold by the National Gramophone Company.

DEPONENT FURTHER AVERS that the National Gramophone Company is entirely responsible financially as shown, among other things, by the fact that it has on hand to-day over forty-one thousand dollars, undivided surplus, which is kept on hand or invested in the business, and this surplus is constantly increasing over and above the dividends being paid.

DEPONENT FURTHER AVERS that the American Graphophone Company, or its agents, are designedly injuring the business of the National Gramophone Company by threatening circulars which they send to the agents of the National Gramophone Company, and are further attempting to reach the same result by an organized system of newspaper manipulation.

DEPONENT FINALLY AVERS that, although the National Gramophone Company has been doing business for over two years, and has been openly and publicly selling Gramophone machinery throughout the country for this time with the full knowledge of the American Graphophone Company and its agents, and despite the fact that the business of the National Gramophone Company has been done just as publicly and on a scale comparable with that of the American Graphophone Company, yet the American Graphophone Company or its agents or its legal representatives have never during all this time given the National Gramophone Company or any of its officers or agents or any of its legal representatives any notice, oral or written, formal or informal, that they, the American Graphophone Company, considered the gramophone machine an infringement of the patent rights of the American Graphophone Company, and that the National Gramophone Company has therefore been proceeding in entire good faith, and by the investment of large capital and by the expenditure of much skill and enterprise in building up a business from which the American Graphophone Company now seeks to reap the benefit.

ORVILLE D. LA DOW.

Sworn to before me this 22nd day of November, A. D. 1898.

[SEAL.]

EMIL T. FUESS,
Notary Public No. 89,
New York Co., N. Y.

UNITED STATES CIRCUIT COURT

For The Southern District of New York.

American Graphophone Company
vs.
National Gramophone Company & Frank Seaman.
} In Equity.

AFFIDAVIT OF FRANK SEAMAN.

County and State of New York, ss:

Frank Seaman, being duly sworn, deposes and says:

That he is a citizen of the United States, residing at Yonkers, in the State of New York, and doing business in the city of New York, upon whom process was served in the above-entitled case, and that he is treasurer of the National Gramophone Company, a corporation organized and existing under the laws of the State of New York.

AND DEPONENT AVERS that he is the licensee of the Berliner Gramophone Company, a corporation of the State of Virginia, which controls certain patents, the inventions of Emile Berliner, relating to gramophones, and that under and in accordance with said license he, the deponent, sells to the National Gramophone Company gramophone machines and records which are, in turn, through the agents of the National Gramophone Company, sold by it to the users throughout the country.

DEPONENT FURTHERMORE AVERS that his business of selling gramophones to the National Gramophone Company would be irreparably injured if it were temporarily enjoined, so much so that it is doubtful whether it could ever again be reconstructed, and this, in deponent's opinion, without any corresponding benefit to the American Graphophone Company, whose machines could not replace those sold by the National Gramophone Company.

DEPONENT FURTHER AVERS that he is personally possessed of large means in stocks and bonds; that he is a director of the Fourteenth Street Bank, and is recognized in the community as a man of financial means and standing.

FRANK SEAMAN.

Sworn to before me this 25th day of November, 1898.
[SEAL.] EDWARD MCCARTHY,
Notary Public, N. Y. Co.

IN THE CIRCUIT COURT OF THE UNITED STATES

For the Southern District of New York.

American Graphophone Company,
Complainant,

vs.

National Gramophone Company and
Frank Seaman,
Defendants.

In Equity.

AFFIDAVIT OF THOMAS S. PARVIN,

ON BEHALF OF DEFENDANTS.

City and County of Philadelphia, }
State of Pennsylvania. } ss:

Thomas S. Parvin, being duly sworn according to law deposes and says: That he is a citizen of the United States, and resident of the City of Philadelphia, and State of Pennsylvania.

That he is President of the Berliner Gramophone Company, a corporation duly organized under the laws of the State of Virginia, having its office in the said City of Philadelphia; and has been President of said Company since its organization October 31st, 1895.

That the said company was organized principally for the purpose of acquiring the exclusive rights under sundry Letters Patent of the United States issued, or to be issued, to Emile Berliner, of the City of Washington, D. C., for certain inventions of the said Berliner relating to certain sound recording and reproducing machines, and parts thereof, commonly known as the "Gramophone," and for manufacturing and selling the said gramophones, and parts thereof, and licensing others to manufacture, sell and use the said inventions.

That the said Berliner Company shortly after the date of its organization acquired from the United States Gramophone Company, the owner of the said inventions and Letters Patent of the said Emile Berliner, the sole and exclusive right to manufacture, sell, and use the said inventions of the said Berliner, and became the sole licensee, among other patents, of the Letters Patent of the United States to said Emile Berliner for Improvements in and relative to said Gramophones, No. 372,786, dated Nov. 8, 1887; No. 382,790, dated May 15, 1888; No. 534,543, dated Feb. 19, 1895, and No. 548,623, dated Oct. 29, 1895. And that the said Berliner Company by said license and grant duly acquired on or about September, 1895, became the sole and exclusive licensee of the said Berliner Gramophones and Improvements thereon and still is the owner of the same.

That on or about October, 1896, the said Berliner Company licensed the said Frank Seaman, one of the defendants in this suit, to buy, sell, and deal in Gramophones and Gramophone goods embodying the said inventions of the said Berliner, and constituted the said Frank Seaman its general selling agent; and that the said Frank Seaman still continues in that capacity.

That shortly after the said Berliner Gramophone Company acquired the said rights under the said Berliner Patents, it made arrangements at great expense to manufacture and sell Gramophones constructed under the said Letters Patent, in large quantities throughout the United States, and shortly thereafter commenced the manufacture of the said machines, and since that time has manufactured the said machines and sold the same through the said Frank Seaman in large quantities throughout the United States, and still continues to an increasing extent the manufacture and sale of the said machines, which have met with a most generous demand and the approval of the public.

That before engaging in the manufacture and sale of the said machines, and before becoming the exclusive licensor of the same this deponent as President of the said Berliner Company was furnished with a legal opinion in writing signed by Messrs. Pollok & Mauro, Patent Attorneys of Washington, D. C., of excellent standing, as this deponent is informed, dated September 28, 1891, addressed to the said Mr. E. Berliner, setting forth distinctly the prior art and stating unequivocally in their opinion that the Berliner method, and instrumentalities then employed in practicing it, were not controlled by any patents except such as were granted to the said Berliner, and such as were then in the course of issue.

This deponent avers that he is familiar with the construction of defendant's machine, such as shown in complainant's Exhibit, Defendant's machine, and with the construction of defendant's records, and the operation of machine, and is also familiar with the general construction and operation of complainant's machine such as commercially used, known as the "Graphophone," and avers that defendant's machines and records are radically different in construction, operation, principle and appearance; and avers, further, that, as far as the public is concerned, defendant's machine could not possibly be mistaken for complainant's, so radically different is it, not only in construction and operation, but in general appearance; and this deponent avers that it has been his policy and practice as President of the said licensee Company to see that every effort be made at all times since the manufacture and sale of the said Gramophone has been commenced that the same should be presented to the public as a talking machine distinctly independent of all other known talking machines, and that it should not be in any manner liable to be confused with or mistaken for the Graphophone, or any other talking machine.

That defendant's machine, this deponent avers, is so far superior as an amusement device for entertainment purposes that it would be greatly to the disadvantage of the defendants that this machine should be in any manner confused with the Graphophone. For such purposes this deponent avers that defendant's machine is so far superior to complainant's devices, or any other talking machine in existence, in the results produced, owing to the radically different method of producing records and the construction of the records, and the means of reproducing the same, that the two machines, as far, at least, as results are concerned, cannot be compared.

This deponent avers that owing to the method and means practiced by defendants in recording sound and producing records thereof in undulatory lines of even depth the record of the sound waves produced upon the tablet is much sharper, more distinct and better defined and as a consequence, can be reproduced with greater distinctness, volume and accuracy than can possibly be produced by records formed by cutting the record in the base of a groove as contained in complainant's records and devices, or by any other known method.

This deponent avers, from actual experience and observation, that in talking machines constructed in accordance with complainant's devices the listener in order to clearly catch and understand the reproduced sound must stand within a few feet of the trumpet attached to the machine, while the reproduced sound from defendant's machine with a small horn, such as used for house purposes, may be distinctly heard in any part of a large auditorium ; may be plainly heard in almost any part of an ordinary dwelling house when the interior doors are open ; and this deponent avers that he has distinctly heard the reproduced sound from defendant's records and machine, on a quiet lake of water where the machine producing the sound was located at a distance of two miles.

This deponent avers that defendant's machine as constructed is adapted only for amusement and entertainment purposes, as distinguished from the commercial use for which complainant's construction is used in business houses in taking letters, etc. from dictation, subsequently to be reproduced by an operator upon the typewriter. Defendant's records from the method of their construction must necessarily be made in the laboratory, or like places, and the machine is, therefore, not adapted for such commercial purposes in this sense. Defendant's machine is, therefore, adapted principally for halls, and for home purposes, in amusing and entertaining audiences by the reproduction clearly, distinctly, and with any desired volume, of songs, instrumental music, recitations, dialogues, etc.

This deponent avers that defendant's records being produced in hard rubber, by reason of the radically different method and construction of apparatus adopted and used by defendants in the construction of records, are far more durable than those produced by complainant's method and mechanism, as well as being very much superior; that said defendant's records are practically indestructible by any ordinary usage, and as the records may be used any number of times, a thousand times if desired, without impairing the quality of the same as records. Wax or wax-like records are necessarily fragile, easily cracked or broken, even when care is taken, and necessarily become valueless or greatly impaired by constant use. They are also very susceptible to climatic changes.

This deponent avers that the said defendant's records, by reason of the method and means employed in their construction, as set forth and described in defendant's patents, can be rapidly produced by matrices in the hard rubber in any desired quantity at a minimum cost, which allows of the same being furnished to the public at a reduced price within the reach of all able to purchase machines.

This deponent avers that since the commencement of the manufacture and sale of defendant's machines by the Berliner Gramophone Company they have been sold continuously in large quantities; that from year to year the sales, and the public demand for the same, have constantly and continuously increased until in the year 1897 the sales amounted to about two hundred thousand dollars, and that an increased number of sales proportionately has been made in the year 1898; that as this deponent is informed and believes over one thousand selling agents are now engaged in the United States for the sale and distribution of the said machines; and that large numbers of machines are now being manufactured and sold in foreign countries.

This deponent avers that the selling price of defendant's machine has been uniformly maintained at twenty-five dollars per machine, notwithstanding the fact that the complainants have for some time past been putting out inferior graphophone machines upon the market at ten dollars per machine to each consumer in order as this deponent believes to undersell the defendant; That notwithstanding said cut in price, and the putting out of cheap machines by the complainant, defendant's sales, by reason of the manifest superiority of the gramophone, have steadily increased.

This deponent avers that although defendant's machines have been constantly upon the market in large quantities for about three or four years last past, and have been constantly advertised by the defendants, with the full knowledge of the complainant and its agents, yet the complainant, or its agent or legal representatives have never given to the defendants, or any of them, or any of its officers or agents, as far as this deponent has been able to ascertain, nor to the Berliner Company, its officers or agents, nor to the United States Gramophone Company, its officers or agents, nor to any parties connected with the manufacture or sale of the defendant's machine, as far as this deponent has been able to ascertain, any notice whatsoever in writing, or otherwise, that defendant's machines were an infringement, or were considered an infringement by the complainant of any of complainant's patents, or of any of its exclusive rights whatsoever, until suit brought in this case; and that the Berliner Company, and its agents, have been proceeding in entire good faith throughout all their transactions in the manufacture and sale of said defendant's machines, and have invested and expended large sums of money in the manufacture, sale and advertisement of the said machines, and in the building up of their said large business.

This deponent avers that the said National Gramophone Company, one of the defendants to this suit, buys gramophones from the said Frank Seaman, as this deponent is informed, and sells the same to the public in the same capacity as any dealer might buy and sell machines from the licensee.

This deponent avers that the said Berliner Company, and the United States Gramophone Company, the owner of the said Berliner Patents, from whom the said Berliner Company has acquired its said license, are desirous of becoming parties defendants to this suit, and this deponent believes that the said companies are abundantly responsible financially to meet the demands of any decree which might be entered in the event of judgment against the defendants after final hearing, should the complainants prevail in this, its said suit.

This deponent avers that great damage and injury has been done to defendant's business by the uncalled for, and unjustifiable notices and advertisements circulated by the complainant company amongst the public threatening all purchasers and users of the defendant's said machine.

This deponent avers that great and irreparable damage and injury would be occasioned to the said defendants, and their business, should the defendants be temporarily enjoined as prayed in the said Motion for Preliminary Injunction, and without any corresponding benefit, in this deponent's opinion, to the complainant; and that the granting of such preliminary injunction against the defendants would occasion a much greater loss and injury to the defendants than any possible loss or damage or injury which the complainant might suffer, if any, by reason of the failure to grant said motion; that the granting of said motion would immediately stop and bring to a standstill defendant's business, and the large business of the Berliner Company, in which many hundreds of thousands of dollars have been invested, and occasion a loss to the defendants which could not be recoverable, and from which it could never fully recover, even after a decree favorable to the defendants upon final hearing.

And further this deponent saith not.

THOMAS S. PARVIN.

Sworn and subscribed before me this 28th day of November, A. D. 1898.

[SEAL.] FRANK D. GRAHAM,
Notary Public.

UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY &
FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF EMILE BERLINER.

CITY OF WASHINGTON, }
District of Columbia, } ss:

Emile Berliner, being duly sworn, deposes and says:

I am a citizen of the United States, residing at Washington, in the District of Columbia, and I am the inventor of new processes of recording and reproducing sounds and of the machines for practicing these processes known as GRAMOPHONES, sold by Frank Seaman to THE NATIONAL GRAMOPHONE COMPANY, and by them to the public, and upon whom, namely, Frank Seaman and the NATIONAL GRAMOPHONE COMPANY, process was served in the above-entitled case. For my above said inventions I have obtained letters patent of the United States as follows:

No. 372,786, dated November 8, 1887;
No. 382,790, dated May 15, 1888;
No. 534,543, dated February 19, 1895;
No. 548,623, dated October 29, 1895;
No. 564,586, dated July 28, 1896.

Patent Office copies of these patents are hereto annexed.

I FURTHER SAY: that in the early part of the year 1877 I engaged in the invention of telephone instruments and I invented numerous such instruments, and, among others, the telephonic transmitter known as the MICROPHONE, which is now universally associated with my name. But prior to my inventions in telephony and subsequent thereto I studied the science of acoustics and became familiar with its laws and its applications to the industrial arts.

I FURTHER SAY: that at an early period of my life, and certainly long prior to the year 1887, I was familiar with the acoustical apparatus invented by Leon Scott, described in ordinary text books on Physics, known as the PHONAUTOGRAPH.

Scott's phonautograph consists of a cylinder that can be rotated, and the surface of which is covered with lampblack; or the cylinder is first covered with paper, and lampblack is deposited upon the surface of the latter. In proper relation to this rotating cylinder is a diaphragm, against which sounds are directed and which carries a light stylus or pencil that inscribes the vibrations of the diaphragm laterally upon the cylindrical surface, by removing from the same an undulatory line, and thus, more or less, lays bare the surface of the cylinder along such line.

I FURTHER SAY: that in the early part of the year 1887 I engaged in the invention of the sound recording and reproducing apparatus which has since become known under the name GRAMOPHONE, and that in the Leon Scott phonautograph I found the germ of the principles which I embodied in my sound recorder and reproducer—namely, the principle that, in order to produce an accurate sound record, the resistance which the diaphragm and the stylus have to overcome in making a record of sounds must be exceedingly small, and that said small resistance must be substantially uniform for all amplitudes of vibration; and in my first attempts at making a sound recorder I followed with the utmost care the footsteps of Leon Scott and never deviated from the fundamental principles thereof.

I FURTHER SAY: that, beginning in the early spring of 1887, with my work on the gramophone, I proceeded to make a sound record upon paper, upon which I had deposited lampblack from a smoky flame. I traced upon this paper an undulatory line, by an exceedingly light stylus, connected with a diaphragm, against which sounds were uttered, the paper being upon a cylinder which was rotated. I thus obtained a phonautographic record, exactly in the manner of Leon Scott. This record I copied in type metal by the process known as photo-engraving, and I finished the same sometime in April, 1887. The type-metal copy of the phonautographic record represented a laterally undulatory groove of substantially even depth, from which sounds were reproduced by a diaphragm and stylus, the latter being passed through the groove, either by moving the stylus or the type-metal record.

I then made phonautographic records upon glass disks covered with lampblack, pure and simple, and again I made phonautographic records upon glass disks covered with lampblack and an exceedingly fine spray of oil, producing a very thin film, consisting of a mixture of lampblack with oil, which is substantially printer's ink.

The phonautographic records thus produced were photo-engraved in metals, and from each of them I reproduced the recorded sounds.

The copying of phonautograms by photo-engraving I discontinued in the early part of 1888, and substituted for it a direct etching process, to which I ever afterwards adhered. Instead of making the phonautogram upon paper or glass, I made it upon a flat zinc disk, which I covered with an almost infinitesimally thin layer of a fatty film, derived from a partial solution of beeswax in benzine; and I then etched, by suitable acids, the undulatory line that I traced through the fatty film, into the zinc, thus obtaining, in the zinc plate, a spiral, laterally undulatory line of substantially even depth. This record gave very good reproduction.

I FURTHER SAY: that in August of 1887, after I had produced the sound record etched in zinc, and had reproduced the recorded sounds from the same, I became accidentally acquainted with the fact that Mr. Charles Cros, a Frenchman, had described certain processes of recording and reproducing sounds, based upon the principle of the Scott phonautograph, and specifically carried out by a process of etching and photo-engraving, the leading idea of which was also to produce a laterally undulatory sound record-groove of even depth, in hard, resisting material. I thus discovered, for the first time, that I had pursued the same general course as had been indicated by Mr. Cros, and I now understand that said Cros is the same person who took out a French patent, No. 124,213, on May 1, 1878.

I FURTHER SAY: that in the spring of the year 1888, in the manner hereinbefore set forth, I had achieved the process of making sound records in metal, and the results obtained were so good that the zinc records, together with the reproducing apparatus, were fit to be placed upon the market; but since I could, thus far, make only one metallic record from each phonautographic sound tracing, or, at best, electrotype copies therefrom, the records were too expensive to warrant their manufacture for commercial purposes.

For this reason I proceeded to devise means for multiplying the gramophone records, by copying the original zinc records in other hard, resisting materials, such as celluloid, and finally in hard rubber and other like hard, resisting compounds, and by the middle of the year 1891 I had completed this task satisfactorily, and had thereby completed my whole system, at which I had begun to work in the early part of the year 1887.

I FURTHER SAY: that the four years which elapsed between the beginning of my work on the gramophone and the time when I had improved every part of the system so completely as to be fit to be offered to the public at a reasonable price, I devoted exclusively to this work, making innumerable experiments in specially equipped laboratories, at great expense and sacrifice; that no part of that time I devoted to other pursuits, but devoted it all to this work, and to nothing else.

I FURTHER SAY: that in the summer of 1891 I was convinced that all my processes and machines had been so improved as to warrant the enterprise of bringing the same into the market; before doing so, however, I sought and obtained the advice of prominent patent counsel, Messrs. Pollok & Mauro, who had been the patent solicitors for Messrs. Bell & Tainter, the inventors of the graphophone, in procuring their patents, and who, consequently, had vast knowledge and experience in talking machines. I requested these gentlemen to ascertain and advise me whether my process and machines infringe the patents of any person or persons, in order that I might know whether I am warranted in soliciting financial and other aid from persons who might be willing to engage in the exploitation of my invention.

For this purpose I submitted to Messrs. Pollok & Mauro, for inspection and study, a recording apparatus built substantially like that which is now employed as a part of the gramophone, and a reproducing apparatus also built substantially like that which is now in public use, with its hard rubber record and the reproducing stylus carried on an arm having both a lateral and vertical swing.

I FURTHER SAY: that Mr. Philip Mauro, as a member of the firm of Pollok & Mauro, on September 28th, 1891, advised me, by a report in writing, that my machines and processes do not infringe any existing patent rights, giving their reasons therefor in full. The said report of Messrs. Pollok & Mauro is hereto annexed.

I FURTHER SAY: that I then felt warranted in soliciting financial aid for the introduction of the gramophone upon the market, and in the year 1894, I began the manufacture of gramophone reproducers and hard rubber gramophone records, through the auspices of the

United States Gramophone Company, a corporation organized under the laws of the State of West Virginia. This company, at that time, had a factory and salesrooms in Baltimore, Maryland, on a prominent business street, did business publicly, and without concealment, and sold in the fall of 1894 about one thousand reproducing machines and about 25,000 hard rubber records. In the year 1895 an agreement was made with the Berliner Gramophone Company, a corporation organized under the laws of Virginia, who continued the manufacture and sale of gramophone machinery and records on a more extended scale and with all possible publicity. During the years 1896, 1897, and 1898 the sale of gramophones has been continued by Mr. Frank Seaman, of Yonkers, New York.

I FURTHER SAY: that despite this public and large sale of gramophone machinery and records, extending over a period of five years, and with the full knowledge of the officers and agents of the American Graphophone Company, I never received any intimation or suggestion of a notice that the gramophone was an infringement of any patent rights controlled by the American Graphophone Company, and I do not know and do not believe that any one connected in any way with the gramophone interests has received such notice.

I FURTHER SAY: I am familiar with the construction and mode of operation of the phonograph, invented by Thomas A. Edison, and also with the construction and mode of operation of the instrument known as the graphophone, described in letters patent of the United States granted to Chichester A. Bell and Sumner Tainter, to wit:

Patent to Bell and Tainter, No. 341,214, dated May 4, 1886;

Patent to Bell and Tainter, No. 341,288, dated May 4, 1886; and

Patent to Sumner Tainter, No. 375,579, dated December 27, 1887;

and I am also familiar with the construction and operation of the graphophone, as the same is publicly sold.

I FURTHER SAY: The Edison phonograph, as well as the graphophone, are based upon radically different principles from those embodied in the gramophone, one of the fundamental differences being that whereas the phonograph and the graphophone produce a sound record consisting of a groove of varying or undulatory depth, in soft, destructible material, the gramophone produces a sound record consisting of a laterally undulatory groove of even depth, in hard, indestructible material.

As a consequence of the difference above pointed out, in the reproduction of sounds from a phonographic or graphophonic record the stylus and diaphragm are actuated by the undulations of the bottom of the record groove, while in the reproductions from a gramophone record the stylus and diaphragm are actuated by the undulations of the sides of the record groove. In other words, the sound records of the phonograph and of the graphophone are represented by the bottom of the record groove, while the sound record of the gramophone is represented by the sides of the record groove.

As a further consequence, in the graphophone the stylus is moved by the undulatory record positively in one direction only, and is moved by the elastic force of the diaphragm in the other direction; whereas in the gramophone the stylus is moved by the undulatory record positively in both directions.

As a further consequence of the differences above pointed out, a very important and novel advantage is secured, in that an undulatory groove of even depth is capable of being copied from the original record, with great perfection, in any other material, whereby I was led to the making of copies of the original metal records in hard rubber, or other like substances; so that the original metal records need not be used at all for the reproduction of sounds, and are, as a matter of fact, not commercially used. I can make thousands or an unlimited number of copies of one original metal record; while neither the graphophone nor the phonograph records can be thus multiplied, if at all.

All this is due to the fact that the graphophone of Bell and Tainter is a development of and improvement upon the Edison phonograph, the merits of which improvement I do not deny; whereas my gramophone is a development of and improvement upon the work of Cros, which proceeds upon an entirely different line.

I FURTHER SAY: that while my reproducer employs a universal joint for supporting the reproducing mechanism, the function and effect of this mounting differs in every essential particular from that of Bell and Tainter. These patentees utilize the lateral movement of the universal joint to permit the stylus to adjust itself within the lateral space of a groove with sloping walls and having a sound record in the bottom of the groove, in such manner that the stylus may come to rest and bear upon the bottom. The sole purpose of the lateral adjustment is to enable the stylus to certainly reach the bottom of the groove, and the useful compass of the adjustment is limited to the width of one groove. In the gramophone the lateral movement permitted by the universal joint replaces the feeding mechanism of Bell and Tainter, consisting of screws and gears, which carry the stylus from convolution to convolution along the record. In the gramophone record no lateral adjustment of the stylus within the groove is necessary. Besides, in the gramophome the lateral movement of the stylus actuates the diaphragm, whereas in the graphophone it is the vertical movement which does this work.

Again, the vertical movement permitted by the universal joint in the gramophone has no other purpose but that of enabling the user to readily remove from or replace the stylus in any preselected groove. It is not necessary that the stylus of the gramophone should go to the bottom of the groove, for so long as the side walls of the groove engage the stylus, reproduction of sound is secured.

It will be seen, therefore, that neither the vertical movement nor the horizontal movement of the universal joint of the gramophone has any function comparable to the movements due to the universal mounting in the graphophone. Certainly there is no centering action of the stylus within the gramophone groove that plays any part in reproducing speech.

To prove these facts experimentally, I took the ordinary gramophone reproducer as sold on the market and arranged a stop device on the arm which positively prevented the stylus from resting against the recording groove by gravity. I succeeded by such a device in reproducing speech as effectively as with the ordinary, unmodified gramophone.

In a second experiment I took a machine which was expressly built to be rigid in every respect, and in which there was no lost motion of any kind in any of its joints, and which was as solid and unyielding as mechanical skill could make it. In this machine, I mounted in a fixed, firm and absolutely unyielding manner the sound box carrying the diaphragm and stylus of a gramophone reproducer. There was no play or lost motion in any direction in the mounting. Under the stylus a rotary but absolutely rigidly mounted bed was placed, with no lost motion, in any of its parts, and a gramophone record tablet was placed thereon with its record groove in engagement with the stylus. It was physically impossible for the stylus to rest by gravity in contact with the record groove, and substantially impossible for even the slightest amount of lateral play. Despite these facts, sound was reproduced as efficiently as on the ordinary commercial gramophone reproducers.

I further say that the Chapman photographs annexed to the Lyons affidavit show exactly the relative shapes of the record grooves of the graphophone and gramophone respectively. The graphophone groove, in cross-section, is exceedingly shallow and the side walls have an exceedingly gentle slope, two adjacent side walls coalescing into a ridge. When the graphophone stylus is set on the graphophone record, it may fall at any one of a number of different places, and so long as the record is at rest it will stay where it is set. But when the record is moved or purposely jarred by the hand of the user, the stylus automatically gravitates to the bottom of the groove. The gramophone grooves, on the other hand, far from being V-shaped, are, if anything, U-shaped, with precipitous side walls, shaped very much like a pit, into which the reproducing stylus fits just as a ball fits a pocket made for it. There is one place, and one place only, where the stylus can be placed. There is no question of automatically adjusting the gramophone stylus within the gramophone record groove, for there is only one place where it can go, and that the right place. In practice the gramophone reproducing stylus is shaped to fit the gramophone record groove somewhat loosely, so that there shall be no initial pressure between the side walls of the groove containing the record and the side faces of the stylus. This enables the side walls most perfectly to impart to the stylus their vibration, undisturbed by any initial friction, which would otherwise have to be overcome.

I further say that May 16, 1888, I read before the Franklin Institute, of Philadelphia, a paper on my invention as it had been developed at that time, a copy of which I have marked "Franklin Institute Lecture Exhibit, E. Berliner," and which accompanies this affidavit.

Emile Berliner.

Subscribed and sworn to before me this 22d day of November, 1898.

[SEAL.] Hugh M. Sterling,
Notary Public.

Pollok & Mauro's Opinion.

Mr. E. Berliner,

Dear Sir: At your request we have examined and considered the method and mechanism devised by you for the recording and reproduction of vocal and other sounds, as set forth in United States patents Nos. 372,786, Nov. 8, 1887, and 382,790, May 15, 1888, and have compared the same with other known methods and apparatus having the same object. Particular attention has been given to the question whether your instrument, commercially known as the gramophone, can be used in this country without infringement of any subsisting and valid patent.

It will be useful, in the discussion and determination of the question submitted to us, to state with brevity the leading points in the history of the art to which your system belongs.

The apparatus as a whole involves two distinct mechanisms:—first, a recorder which forms a record corresponding to the sounds produced in the vicinity of the instrument; and, second, the reproducer, which converts the recorded vibrations of the original sounds into atmospheric vibrations of corresponding form, and so renders them audible.

The formation of sound records long antedated the mechanical reproduction of recorded sounds.

About thirty-five years ago, the first known apparatus for recording sound was devised by Leon Scott, and is familiar to science under the name of the "Phonautograph."

Briefly described, it consisted of a stretched membrane, constituting a diaphragm, and a hog's bristle secured thereto and constituting the recording stylus. For the recording medium or surface, Scott used a sheet of paper coated with a thin layer of lampblack. By moving such a prepared sheet slowly under the point of the bristle while the latter vibrated with the diaphragm, responsive to sound-waves, the bristle displaced in its movement the particles of lampblack in its path, and produced a wavy or undulatory line, the figures thus obtained faithfully denoting the "number, amplitude and isochronism of the vibrations." (Ganot's Physics.)

This is substantially the principle upon which all modern instruments operate to produce a sound record, though, as we shall have occasion to notice, modifications of greater or less importance have been made in the form and operation of the instrument, and in the recording medium or tablet.

Scott's machine was of scientific interest only. It served as an aid to the study of acoustical phenomena, but he had no means of reproduction and suggested none. This suggestion came first in point of time, if not in point of public notoriety, from a Frenchman, M. Chas. Cros, who, on April 30, 1877, some six months or more prior to the public disclosure of Edison's phonograph, deposited with the Royal Academy a descriptive memoir, suggesting a plan whereby sounds, recorded by means of the Scott phonautograph, might be audibly reproduced. The method proposed was, to make a copy of the phonautograph record by photo-engraving, and to reproduce from this copy by means of a style attached to a vibratory diaphragm. This suggestion embodied a plan capable of being practically carried out, as your own subsequent work demonstrated; but it appears that Cros himself never put it into practice.

In the fall of the same year, 1877, Mr. Edison produced his first crude phonograph, and is entitled to the credit of being the first person to realize practically the mechanical reproduction of sound from a sound record. His patent of February 19, 1878, broadly covered the operation of reproducing in the manner in which all subsequent instruments, including your own, accomplished it; but as this invention was included by Edison in his British patent No. 2909 of 1877, which expired in June, 1891, his U. S. patent under our law (Sec. 4887, R. S.) expired simultaneously, and there is consequently no patent in existence covering broadly the art of reproducing sounds by vibrating a style through contact with an undulatory sound record.

Edison's method of recording the sounds differed in certain important particulars from that of Scott, though the principle of utilizing the vibrations of a style connected with a vibratory diaphragm was preserved. Edison employed a rigid style, whose point impressed the record upon a sheet of pliable substance, such as tinfoil, by indentation. This may be called, for brevity's sake, the "indenting" method, and it is to be noted that the record so produced is different from Scott's phonautogram, in that the zig-zag line of the latter lies upon the surface of the recording tablet, whereas the record of the Edison phonautogram is a groove of uniform direction, but impressed or indented to varying depths in the pliable sheet. In other words, Scott's instrument writes the graphic symbol of the sound upon a flat sheet, while the Edison phonograph *gouges* or *indents* it in the body of the recording medium. The distinction is clear, and is of importance in the subsequent operation of reproducing.

For nearly ten years after the brief excitement and interest aroused by the Edison phonograph had subsided, absolutely no advance was made in this important and interesting art. The phonograph remained during all that period a scientific curiosity, but without commercial utility.

In the year 1886, however, a great stride was taken in the development of the art, the advance being due to the studies and experiments of Prof. A. Graham Bell, Dr. Chichester A. Bell, and Prof. Chas. Sumner Tainter, who, in that year, disclosed through their letters patent (dated May 4) a number of improvements in the mechanism and modes of operation, the practical embodiment of their inventions constituting the type of instrument known as the "graphophone."

Inasmuch as the expiration of Edison's original patent of 1877 has thrown open to the public the broad method of reproducing sounds mechanically by vibrating a stylus from a sound record, the most comprehensive patents in force are those covering the graphophone system.

The most striking and important feature of the graphophone method, and that which essentially characterizes and distinguishes it, is the formation of a record, not by indentation as done by Edison, nor by displacement as by Scott, but by actual cutting or engraving in a substance sufficiently soft for the action of the cutting style and sufficiently hard for the purposes of reproduction. In this system the style is a chisel or graver's tool, the point of which is constantly embedded in action in the recording tablet. As the chisel vibrates, following the diaphragm to which it is attached, it removes a shaving, forming in the solid medium a groove of varying depth. The substance practically employed as the recording medium is wax, or a waxy composition, such as beeswax or paraffine.

The method of reproduction from such a record is identical, in every essential particular, with that of Edison's first patent, namely, the point of the reproducing style, attached to the diaphragm and supported so as to have the requisite freedom of motion, is allowed to rest upon the undulatory bottom of the groove cut in the wax tablet, and as the latter is moved at uniform speed its elevations and depressions throw the style into vibrations corresponding with the form of the record, thus reproducing the original sounds.

The graphophone patents cover many improvements new at that time, and include several hundred claims, which we have reviewed in connection with our study of your system.

From 1886 inventive work in this field has been very active, principally in the direction of developing and perfecting the mechanical details of the graphophone and phonograph. These may be regarded for our purposes as one and the same instrument, for in all material respects they are identical in construction and operation.

The commercial or "improved" phonograph no longer indents in a pliable sheet, but is equipped with a cutting style which engraves or gouges the record in solid wax, forming a groove of varying depth. In fact, when the merits of this cutting system and the use of a solid wax tablet became known, Mr. Edison paid it the compliment of claiming it as his own invention. With the merits of this claim we have, of course, no present concern.

We may now turn to the gramophone, which marks the next important departure in the art, and is described in your patents mentioned above. Descriptions also appeared in prominent scientific papers as early as November 12, 1887.

It is apparent at a glance that this system is the result of work in a line altogether different from that pursued by Edison and his followers, and in fact is the practical development of the ideas of Edison's predecessors, Leon Scott and Chas. Cros.

We will briefly outline the distinctive features of the gramophone for the purpose of showing that it possesses nothing in common with its contemporaries, the graphophone and improved phonograph, excepting that has become public property through the publications of Scott and Cros and through the expiration of Edison's original patent of 1877.

The system follows closely Scott's method of making a record, and therefore could not, so far as that part of the operation goes, be subject to any existing patent.

The method is as follows:

A plate of zinc or other metal is coated with a fatty film (obtained by dissolving the soluble portion of beeswax) and in this film the record is *written* by the vibrating stylus in an irregular or zig-zag line, removing the particles in front of the point of the stylus, and exposing the surface of the plate beneath. So far we have Scott's method exactly, with the exception that for a fatty hydrocarbon another but analogous material is substituted, which opposes even less resistance than lampblack to the motions of the style. Now comes the original step of making this record permanent and available for reproduction, which is done, in the preferred mode, by etching. The waxy or fatty film is used as an etching ground, and consequently when the plate is immersed in a suitable bath the acid can attack only the lines exposed through the film—that is, the zig-zag path along which the recording stylus has written the form of the sound-waves under whose influence it was vibrated. The result is a record etched in solid metal, from which, if desired, any number of copies can be made.

We have, then, at the present day, three methods (one of them commercially worthless) of making a permanent sound record available for reproduction—namely, the "indenting" method of the early phonograph, the "cutting" method of the graphophone, and the "etching" method of the gramophone.

The latter is not only distinct and independent as an operation, or mode of procedure, but it produces a record having properties and peculiarities that distinguish it from sound records made by the other methods. One characteristic advantage of your method is understood to be that it affords the means of obtaining with perfect accuracy the curves or undulatory lines which represent the form of sound-waves. In tracing the record in the fatty film, the latter opposes to the movement of the style a resistance that is not only very slight *but is* uniform at all times. Consequently there is no distortion of the form of the vibrations. On the other hand, when the record is *indented* or *cut* in the body of the recording medium to a depth varying with amplitude of the vibrations of the style, the resistance to the latter is variable, and distortion to a greater or less extent is unavoidable.

In comparing your mode of reproduction with that of the graphophone (or of the improved phonograph) it is important to have in mind the peculiar and distinct character of the gramophone record, to which we have already made reference. In the etched tablet the groove is or may be of uniform depth, that being of no consequence; whereas in the graphophone record the varying height of the bottom of the groove constitutes the record, and the whole of it. In the etched tablet the record is formed along the sides or edges of the groove, there being in fact two records, one on each of the two parallel edges.

Obviously, for the purpose of reproduction, each of these records calls for appliances, and involves a mode of operation peculiar to itself and different from the other. In the etched record the point of the reproducing style is guided continuously by the parallel edges of the sinuous groove, the movement being sidewise and positive in both directions. With the graphophone record the style vibrates up and down, and its movement is positive in one direction only, namely, when it is pushed upwards in ascending to the crest of an elevation. In descending into a depression, it must rely on the gravitation of the style, or on a spring, or upon the elasticity of the diaphragm, to make it follow the curve of the line, and to prevent its skipping from one elevation to the next. From this it will be understood why in the graphophone the use of a style resting by gravity upon the record is a feature of so much importance. In the gramophone the use of a reproducer of this character is inadmissible. Neither gravity nor spring pressure is a factor of the operation. The style does not rest upon the record at all, but is free to swing in both directions as the edges of the groove between which it lies direct its movements.

It would serve no useful purpose to enter into a detailed discussion of the many claims found in the graphophone and other subsequent patents. It is sufficient to say that in our opinion your method, and the instrumentalities employed in practising it, are not controlled by any patents, except those granted to yourself and such as may be in course of issue. In reaching this conclusion we have given due consideration to all claims and contentions that might be advanced, and we may say that our familiarity with the subject under discussion enables us to come at once to those points at which your system might be supposed to approach the closest to those that antedated it. It has been suggested, as a matter of popular misapprehension, that the graphophone patents cover the making of records in wax or waxy substances, and that your use of a waxy film as an etching ground is an infringement. In fact, however, the graphophone patents do not, and could not, cover the use of wax broadly for such purpose. The invention which they cover is the formation of a record in a solid body (such as wax) by *cutting* or *engraving*. The use of wax is only claimed when the record is cut or engraved therein. In your recording process the waxy, or more properly the fatty, film is not cut and does not contain the permanent record. It serves only a temporary purpose, to which there is nothing at all analogous in the graphophone method. But apart from all this, Scott used a fatty film in precisely the same way as it is used by you, thirty years before the graphophone patents were issued, which precludes the possibility of any charge of infringement based upon the use by you of a fatty or even a waxy film.

It is beyond all dispute that in its essential and distinguishing principles of operation the gramophone system is substantially and materially different from the phonograph or graphophone. The points of resemblance, if any exist, must be found in detail of minor importance, which would not effect the main question. The development of the two systems, however, has been upon divergent lines, so that features peculiar and important to the one are of necessity inapplicable to the other; and we have not found in your instruments and method of procedure any detail, device, or operative step which could be properly said to infringe upon any unexpired patent.

We therefore conclude that you can lawfully make and use the gramophone in its present form.

With reference to the scope of your patents, a few words will suffice to say all that is necessary.

Patent No. 372,786 covers the three essential steps of (1) tracing a line in a travelling layer of non-resisting material, (2) producing the record thus obtained in solid material, and (3) using the latter to impart vibrations to a sonorous body.

Patent No. 362,790 covers broadly the method of producing a sound record by etching, as well as certain subordinate details or processes of practical importance for the successful operation of the invention.

In our opinion the patents aptly describe the invention, and are adequate to secure and protect it.

Very respectfully,
(Signed) POLLOK & MAURO.

Have examined the proposed changes and approve of them. P. M.

(No Model.)

E. BERLINER.

GRAMOPHONE.

No. 372,786. Patented Nov. 8, 1887.

Fig. 1.

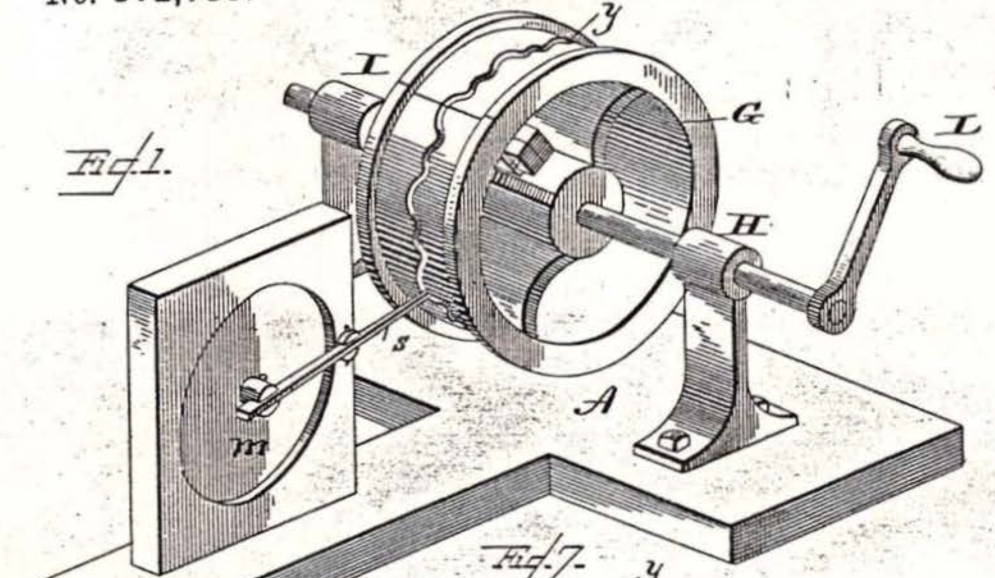


Fig. 7.

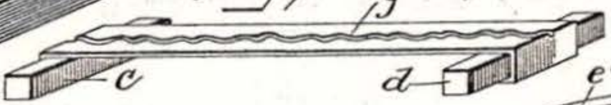


Fig. 3.

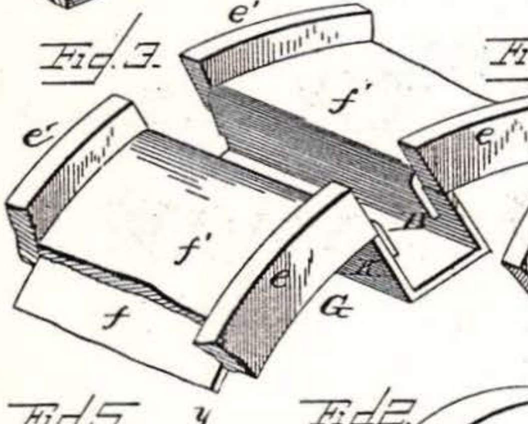


Fig. 4.

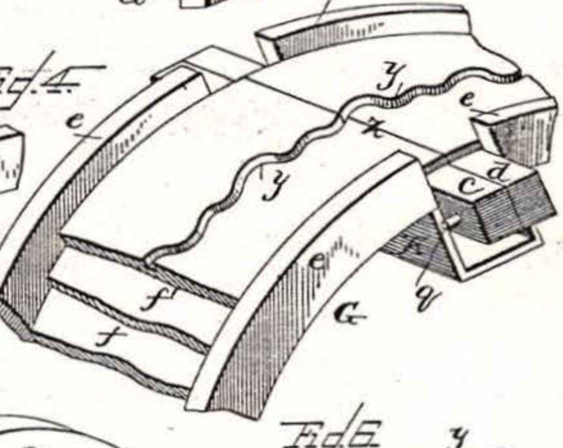


Fig. 5.

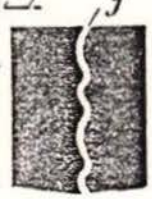


Fig. 2.

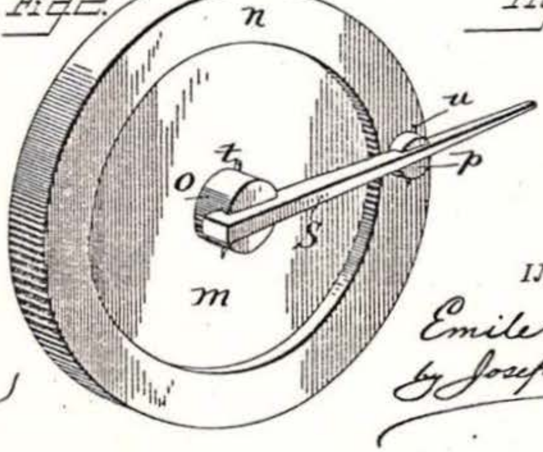
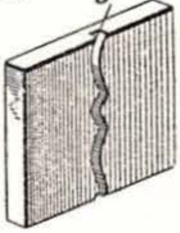


Fig. 6.



WITNESSES

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UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 372,786, dated November 8, 1887.

Original application filed May 4, 1887, Serial No. 237,060. Divided and this application filed September 26, 1887. Serial No. 250,721. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

This invention has reference to a novel method of and apparatus for recording and reproducing all kinds of sounds, including spoken words, and is designed to overcome the defects inherent in that art as now practiced and in the apparatus used therefor.

By the ordinary method of recording spoken words or other sounds for reproduction it is attempted to cause a stylus attached to a vibratory diaphragm to indent a traveling sheet of tin-foil or other like substance to a depth varying in accordance with the amplitudes of the sound-waves to be recorded. This attempt is necessarily more or less ineffective, for the reason that the force of a diaphragm vibrating under the impact of sound-waves is very weak, and that in the act of overcoming the resistance of the tin-foil or other material the vibrations of the diaphragm are not only weakened, but are also modified. Thus while the record contains as many undulations as the sounds which produce it, and in the same order of succession, the character of the recorded undulations is more or less different from those of the sounds uttered against the diaphragm. There is, then, a true record of the pitch, but a distorted record of the quality of the sounds obtained. The simple statement that the material upon which the record is made resists the movement of the diaphragm is not sufficient to explain the distortion of the character of the undulations, for if that resistance were uniform, or even proportional to the displacement of the stylus, the record would be simply weakened, but not distorted; but it is a fact that the resistance of any material to indentation increases faster than the depth of indentation, so that a vibration of greater amplitude of the stylus meets with a disproportionately greater resistance than a vibration of smaller amplitude. For this reason loud sounds are even less accurately recorded than faint sounds, and the individual voice of a loud speaker recorded and then reproduced by the phonograph cannot be recognized. With a view of overcoming this defect it has been attempted to engrave instead of indent a record of the vibrations of the diaphragm by employing a stylus shaped and operating like a chisel upon a suitably-prepared surface; but even in this case the disturbing causes above referred to are still present. In addition to this, if in the apparatus of the phonograph or graphophone type it is attempted to avoid the disturbing influence of the increase of resistance of the record-surface with the depth of indentation or cut as much as possible by primarily adjusting the stylus so as to touch the record-surface only lightly, then another disturbing influence is brought into existence by the fact that with such adjustment, when the diaphragm moves outwardly, the stylus will leave the record-surface entirely, so that part of each vibration will not be recorded at all. This is more particularly the case when loud sounds are recorded, and it manifests itself in the reproduction, which then yields quite unintelligible sounds.

It is the object of my invention to overcome these difficulties by recording spoken words or other sounds without perceptible friction between the recording-surface and the recording-stylus, and by maintaining the unavoidable friction uniform for all vibrations of the diaphragm. The record thus obtained, almost frictionless, I copy in a solid resisting material by any of the methods hereinafter described, and I employ such copy of the original record for the reproduction of the recorded sounds.

Instead of moving the recording-stylus at right angles to and against the record-surface, I cause the same to move under the influence of sound-waves parallel with and barely in contact with such surface, which latter is covered with a layer of any material that offers a minimum resistance to the action of a stylus operating to displace the same, all substantially in the manner of the well-known phonautograph by Leon Scott. All this will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, which illustrate one of the numerous forms which my improved apparatus may assume, and in which—

Figure 1 is a perspective view of my recording and reproducing apparatus; Fig. 2, a like view of the recording and reproducing diaphragm with its stylus; Fig. 3, a similar view of a portion of the support for the record-surface; Fig. 4, the same view with the record-surface applied; Fig. 5, a plan view of a phonautographic record; Fig. 6, a perspective of a phonautographic record copied in solid resisting material; and Fig. 7, the copied record mounted, ready for application to the support.

The general arrangement of the parts is best illustrated in Fig. 1, in which a T-shaped base-plate, A, is shown, upon which two standards, H I, serving as journal-bearings for the shaft of drum G, are mounted. The drum G may be constructed with flanges *e e'*, which project beyond the cylinder-surface *f*, and from the edges of a gap, B, left upon the cylinder-surface extend the side walls of box K, as shown. A thin layer of felt or other yielding elastic substance is placed upon the cylinder-surface and is bent over the edges of the gap and secured to the side walls of the box K. This layer of elastic material is designed to serve as the support for the record-surface both in recording and reproducing.

For recording I employ a thin strip of paper, parchment, metal, or any other suitable substance, which is secured at both ends to bars *c d*, in the manner shown in Fig. 7, with reference to a copy of a record, and is then placed upon the elastic support *f'*, with the bars *c d* entering into but projecting at both ends beyond the box K, as illustrated in Figs. 1 and 4, with reference to an engraved copy of a record. Bolts *q*, passing through the projecting ends of bars *c d*, are employed to draw the record-strip tightly about the drum, and the length of the strip is such that the ends of the same meet as nearly as practicable upon a straight line, *z*. The record-sheet is then prepared to receive the record by covering its surface with a thin layer of any substance which is easily removed by the action of the recording-stylus. I may use lamp-black, which is deposited by placing a smoky flame under the record-strip and by slowly turning the drum until all parts of the strip are covered with the deposit. It is well known that a layer of lamp-black thus deposited, while it adheres well to the surface of a solid body, is nevertheless easily removed from the same. It requires only an exceedingly small force to draw a plainly-visible line upon such surface, owing to the fact that the spicules of carbon of which lamp-black is composed are only loosely superimposed upon each other, and are exceedingly light. All this has long since been recognized and utilized in the production of phonautographic records, and I take advantage of these facts in my improved method of recording and reproducing sounds.

The diaphragm *m* is mounted in a frame, *n*, with its plane at right angles to the axis of drum G. A post, O, is fixed to the center of the diaphragm, and a slot in said post receives one end of stylus S, which is pivoted in the post by a pin, *t*. The stylus extends over and beyond the frame, with its free end barely in contact with the record-surface, and is also pivotally supported in a slot in a post, *p*, secured to the frame by means of a pin, *u*, as shown in Figs. 1 and 2. It will now be seen that the stylus is in effect a lever having its fulcrum in the pin *u*, and that its free end can only move in lines practically parallel to the record-surface. If it is now desired to produce a record of sounds the drum is slowly and uniformly rotated by means of crank L, or by any other suitable means, and sounds are uttered or directed against the diaphragm. Under the impact of the sound-waves the diaphragm is set into vibrations, whereby the free end of the stylus is also caused to vibrate to the right and left of its normal position, removing at the same time an undulating line, *y*, of lamp-black from the record-surface, as indicated, greatly exaggerated, in Fig. 5. Since in this operation the stylus only penetrates a uniform layer of loosely-heaped carbon spicules and barely touches the record-surface, it is clear that the slight friction at the free end of the stylus will be uniform, whatever be the amplitude of vibration. Consequently the vibrations of the diaphragm will not be modified or changed by the reaction upon the same of a sensible and varying resistance, as is the case in all other mechanical sound-recorders.

Having thus obtained an accurate phonautographic record, the same may be fixed by applying a thin solution of varnish of any kind which dries very rapidly and which does not obliterate or change the record.

If in this process the deposit of lamp-black be made thick enough, the line drawn by the stylus would represent a groove of even depth, preserving all the characteristics of the sounds which produced it and which may be handled and touched with impunity. The latter is then removed from the drum and may be preserved any length of time without danger of its being disfigured. This record I then copy in solid resisting material, preferably metal, either by the purely mechanical process of engraving, or by chemical deposition, or by photo-engraving. I prefer the last-named process, which enables me to produce the most accurate copy of the original record in copper, nickel, or any other metal without in any way or manner affecting the original record. The copy thus obtained, which may be multiplied to any desired extent, is a grooved wave-line upon a strip or sheet of copper or other metal, as shown in Figs. 1, 4, 6, and 7, and for the reproduction of the recorded sounds it has the advantage over the ordinary records in tin-foil, wax, &c., that it is not sensibly attacked by the reproducing-stylus, and will stand an indefinite number of reproductions without the slightest variation in the accuracy and loudness of the reproduced sounds.

The copied record is fixed at both ends to the bars *c d*, as shown in Fig. 7, and is placed upon the elastic support f' upon the drum in the same manner as has been described with reference to the original record-strip, and as is illustrated in Figs. 1 and 4. Care must be taken that the two ends of the undulatory groove y meet exactly, as will be readily understood. This condition of the apparatus is shown in Fig. 1 with the engraven record upon the drum and the free end of the stylus entering the undulatory groove. If, now, the drum is rotated with uniform speed, the end of the stylus will be forced to follow the undulations of the groove y, and the diaphragm will be vibrated positively in both directions in strict accordance therewith, and will therefore reproduce the exact sounds which originally produced the record. This peculiarity of positive vibratory movement in both directions of the diaphragm is a feature which also distinguishes my method and my apparatus from others heretofore used.

In the phonograph- and graphophone the end of the reproducing-stylus which bears upon the indented or engraved record has a vertical upward and downward movement. It is forced upwardly in a positive manner by riding over the elevated portion of the record, but its downward movement is effected solely by the elastic force of the diaphragm, which latter is always under tension. In my improved apparatus the stylus travels in a groove of even depth and is moved positively in both directions. It does not depend upon the elasticity of the diaphragm for its movement in one direction. This I consider to be an advantage, since by this method the whole movement of the diaphragm is positively controlled by the record, and is not affected or modified by the physical conditions of the diaphragm, which conditions necessarily vary from time to time and constitute some of the causes of imperfect reproduction of recorded sounds.

In practicing my method of recording and producing sounds I am not limited to the use of the identical apparatus herein shown and described. This apparatus may be varied indefinitely without seriously impairing its utility for the purposes in view. Thus it is not absolutely necessary that a diaphragm should be used for receiving the impact of sound-waves in recording and for remitting sounds in reproducing. Any sonorous body of whatever shape and material may be used in lieu of a diaphragm proper. The recording-surface need not be mounted upon a drum, but may be supported in any suitable manner upon a support of any description which is adapted to move the same under the stylus evenly and with approximately uniform speed. Nor do I confine myself to the use of lamp-black as a substratum for the phonautographic record, although I have found this substance to yield excellent results. Any other substance which adheres well to the support and may at the same time be removed from the same with a minimum force may be employed.

While I have found the process of photo-engraving to yield admirable copies of the phonautographic record, I do not mean to confine myself to this process to the exclusion of other processes for copying and multiplying the original record in solid resisting material; and it will be readily understood that the details of construction of my apparatus and the manipulations of the same may be greatly changed without departing from the fundamental idea of my invention.

I do not herein claim the apparatus shown and described, either generically or specifically, as a whole or in part, since the same forms the subject of another application for patent previously filed by me and of which this is a division.

What I do claim, and desire to secure by Letters Patent, is—

1. The method or process of recording and reproducing spoken words and other sounds, which consists in first drawing an undulatory line of even depth in a traveling layer of non-resisting material by and in accordance with sound-vibrations, then producing the record thus obtained in solid resisting material, and finally imparting vibrations to a sonorous body by and in accordance with the resisting record, substantially as described.

2. The method or process of reproducing sounds recorded phonautographically, which consists in copying the phonautographic record in solid resisting material, and then imparting vibrations to a sonorous body by and in accordance with the copy of the orignal record, substantially as described.

3. The method or process of reproducing sounds recorded phonautographically, which consists in copying the phonautographic record in solid resisting material by the process of photo-engraving, and then imparting positive to-and-fro movements to a sonorous body by and in accordance with the copy of the original record, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:

JULIUS SOLGER,

JACOB G. COHEN.

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

PROCESS OF PRODUCING RECORDS OF SOUND.

SPECIFICATION forming part of Letters Patent No. 382,790, dated May 15, 1888.

Application filed March 17, 1888. Serial No. 267,565. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Producing Records of Sounds, of which the following is a specification.

In a patent granted to me November 8, 1887, No. 372,786, I have described a method of recording and reproducing spoken words and other sounds; and in connection therewith and as a part thereof I have described a process of producing a record of sound-waves in solid resisting material by photo-engraving, the phonautographic record of such sound-waves having first been produced as an undulatory line of even depth in a traveling layer of non-resisting material.

My present invention is an improvement upon that described in my aforesaid patent; and it has for its object the production of a record of sound-waves in solid resisting material, principally metal, by the process of direct etching, whereby a solid unchangeable sound-record is obtained more cheaply and more readily, either upon a flat or upon a curved surface, without the delicate and intricate manipulations incidental to the process of photo-engraving. All this will more fully appear from the following detailed description, in which I shall freely refer to what is shown and described in my aforesaid patent as a part of the now common knowledge of mankind.

In accordance with the rules laid down in my patent, I produced a phonautographic record upon a traveling layer of lamp-black or other non-resisting material. Then this phonautographic record was transferred by photo-engraving upon metal, and the metallic record thus obtained was used for reproducing the recorded sounds.

In the course of my experiments I have found that in place of lamp-black other substances may be used as the non resisting medium for receiving the original phonautographic record, and I have also found that among these substances are such as will resist the chemical action of acids, but which offer no perceptible mechanical resistance to the movement of the recording-stylus. Upon this discovery my present invention is based, and it consists, broadly speaking, in producing a phonautographic record through a film of a suitable etching-ground deposited upon a traveling surface of resisting material, such as metal or glass, and then subjecting said surface to the action of a suitable etching agent, which attacks said surface at the places only where the etching-ground has been removed by the recording-stylus.

The etching-ground, which is to serve as the non-resisting medium for the phonautographic record, I prepare by dissolving beeswax, paraffine, or other like substance in a suitable solvent. By preference I use beeswax, and dissolve the same in benzine, so as to obtain a saturated solution. This solution is filtered, and care is taken to exclude as much as possible all dust, which is always present in the ambient air. The surface which is intended to receive this ground, which may be a flat disk or a cylinder of metal or glass, should be smoothly polished, and must be cleansed and dried. The wax solution is then poured over this surface, so as to cover the same at all points, and the solvent is then allowed to evaporate, which it does in one or two minutes. An exceedingly-fine film of wax then remains adhering to the surface of the metal or glass, and the consistency of this wax is such that it offers no perceptible mechanical resistance to the action of the recording-stylus, while at the same time it resists the chemical action of ordinary etching agents. In this respect the film of wax deposited from the solution is quite different from a layer of wax produced by melting. The latter has such consistency and adheres to the supporting-surface with such tenacity that considerable force must be used to penetrate the same and remove it from its support, while the wax film deposited in the manner described is so delicate that a camel's-hair brush will disturb it perceptibly.

Partly on account of the too great sensitiveness of a single film, and also as an additional protection against the action of the acids employed in the subsequent etching, I ordinarily, but not necessarily, apply a second coating of the solution, which, when dry, leaves a film of wax of such thickness as I have found to answer all requirements. A plate or cylinder thus prepared may be preserved indefinitely, and is at all times in good condition to receive the phonautographic record. Such record is produced by moving the prepared surface under a stylus actuated by sound-waves to remove an undulatory line of the non-resisting film from its support, whereby the latter is laid bare along the said line, as is fully described in my patent above referred to, and as is now well understood by those skilled in the art. The plate or cylinder is then subjected to the action of a suitable etching agent, the nature of which varies according to the material of the support. For metals—such as zinc, copper, or brass—diluted nitric, hydrochloric, or other acid is used, while for glass or other like materials fluoric acid, or the fumes of the same, must be used. In either case I obtain upon the support within a few minutes an undulatory groove of even depth representing the sound-waves which acted upon the recording-stylus, and this groove is of sufficient depth to guide and control a reproducing-stylus in the manner set forth in my Patent No. 372,786.

I do not confine myself to any particular mode of etching, the ordinary process being followed in this respect. The same is true of the practice of rebiting, if a single exposure to the etching agent should prove to be insufficient to produce a groove of sufficient depth. From a record produced in the manner described any number of copies may be obtained by electro-deposition, especially if the original record is etched in metal. In that case, however, I have found it advisable to burnish the original record groove before the plate or cylinder is placed into the depositing-bath. This is a very simple process, and consists in holding and gently pressing a pointed burnishing-tool in the record-groove while the plate or cylinder is rotated. The tool is held in one hand while the plate or cylinder is rotated by the other. In this manner the burnishing-tool is guided through the record-groove from one end to the other, and the slightly-granular structure of the etched groove is thus polished without losing any of its essential characteristics. This process occupies only a very few minutes, and while it improves the galvano-plastic copy obtained from the original record, it is not absolutely essential. In place of a special burnishing-tool the reproducing-stylus may be used, the point of which is ordinarily of hard metal—such as iridium—so that the burnishing is effected by simply using the record once or twice for reproducing the recorded sounds in the ordinary manner.

It has been stated above that the dissolved and filtered wax or other ground should be carefully protected again t dust, which is always present in the surrounding air, and it is obvious that the same precaution should also be taken with respect to the plate or cylinder upon which the record is made; but experience has shown that it is almost impossible to guard effectually against the accession of fine filamentary particles of dust to and into the body of the tracing or etching ground. These dust particles are so fine that they cannot, as a rule, be detected by the most searching inspection of the prepared plate; but they become very conspicuous and a very serious source of annoyance when the record is made. As the recording stylus passes through the wax or other ground, a fine undulatory line of the latter is removed, and the removed material drops away from the stylus as soon as removed, so that the point of the stylus always remains clean. This, however, is only the case when the ground is free of filamentary impurities; but if filaments of dust are embedded in the ground they adhere to the stylus, and, together with a coating of the ground, are dragged through newly-formed grooves, whereby the latter become uneven and receive ragged edges, which seriously impair the accuracy of the record. I have discovered an effective means for overcoming this difficulty, and it consists in simply moistening the record-surface with a fluid that slightly adheres to the ground and keeping it moist while the record is being made. I have found strong alcohol to be very effective for this purpose when wax is used as a tracing-ground, and it is used by pouring it over the ground just before the plate or cylinder is started to move under the recording-stylus. The alcohol evaporates rapidly, but not so rapidly as to disappear entirely before the record is finished, and this record now shows no trace of inequality, the lines being as sharp and well defined as if cut by a graver. The point of the stylus remains quite clean, and it seems as if the filamentary particles had disappeared. I have no definite theory by which to explain this surprising result. It is possible that the exceedingly-fine dust particles are forced against the walls of the grooves and are there held when the ground is in the peculiar state of dampness which it receives when alcohol is poured over the same. It is also possible that these particles of dust, being probably of organic matter, are dissolved by the alcohol, and it is also possible that both causes operate to keep the point of the stylus clean, so as to make a sharp and well-defined record; but whatever be the mode of action of the alcohol poured over the ground its effect is highly beneficial and its use constitutes one of my improvements.

The film of ground which I employ is so exceedingly thin that it is practically colorless and transparent. The record is for this reason almost invisible to the naked eye. In some cases, however, it is desirable to be able to inspect and scrutinize the record before it is exposed to the action of the etching agent, or to watch the progress of the record, and for this reason it is advisable to slightly color the ground before the record is made. I accomplish this by adding a small quantity of aniline-dye or other coloring-matter to the solution of wax or other ground. The record is then plainly visible as a pale line upon a dark ground.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. The method or process of producing a record of sound-waves in solid resisting material for reproduction of the recorded sounds, which consists in covering the surface of such material with a film of etching-ground that offers no perceptible mechanical resistance, then making a phonautographic record upon and through the etching-ground, and then exposing the record to the action of a suitable etching agent, substantially as described.

2. The method or process of producing a record of sound-waves in solid resisting material for reproduction of the recorded sounds, which consists in depositing upon the surface of such material a film of wax from a solution of the same in a suitable menstruum, then making a phonautographic record upon and through the wax film, and then exposing the record to the action of a suitable etching agent, substantially as described.

3. The method or process of producing a record of sound-waves in solid resisting material for reproduction of the recorded sounds, which consists in depositing upon the surface of such material a film of wax from a solution of the same in benzine, then making a phonautographic record upon and through the wax film, and then exposing the record to the action of a suitable etching agent, substantially as described.

4. The method or process of preparing solid surfaces for the reception of a phonautographic record, which consists in depositing upon said surfaces a film of tracing or etching ground and then moistening such film with an adhering fluid, substantially as described.

5. The method or process of preparing solid surfaces for the reception of a phonautographic record, which consists in depositing upon said surfaces a film of wax and then moistening the wax film with alcohol, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:
JOSEPH LYONS,
S. WOLF.

when this patent was taken out Mr Lyons still held that the Etching film was wax. It is however so utterly different in its physical properties that although one of the fatty constituents of beeswax the expression "fatty film" alone is justified.

EB.

(No Model.)

4 Sheets—Sheet 1.

E. BERLINER.

GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

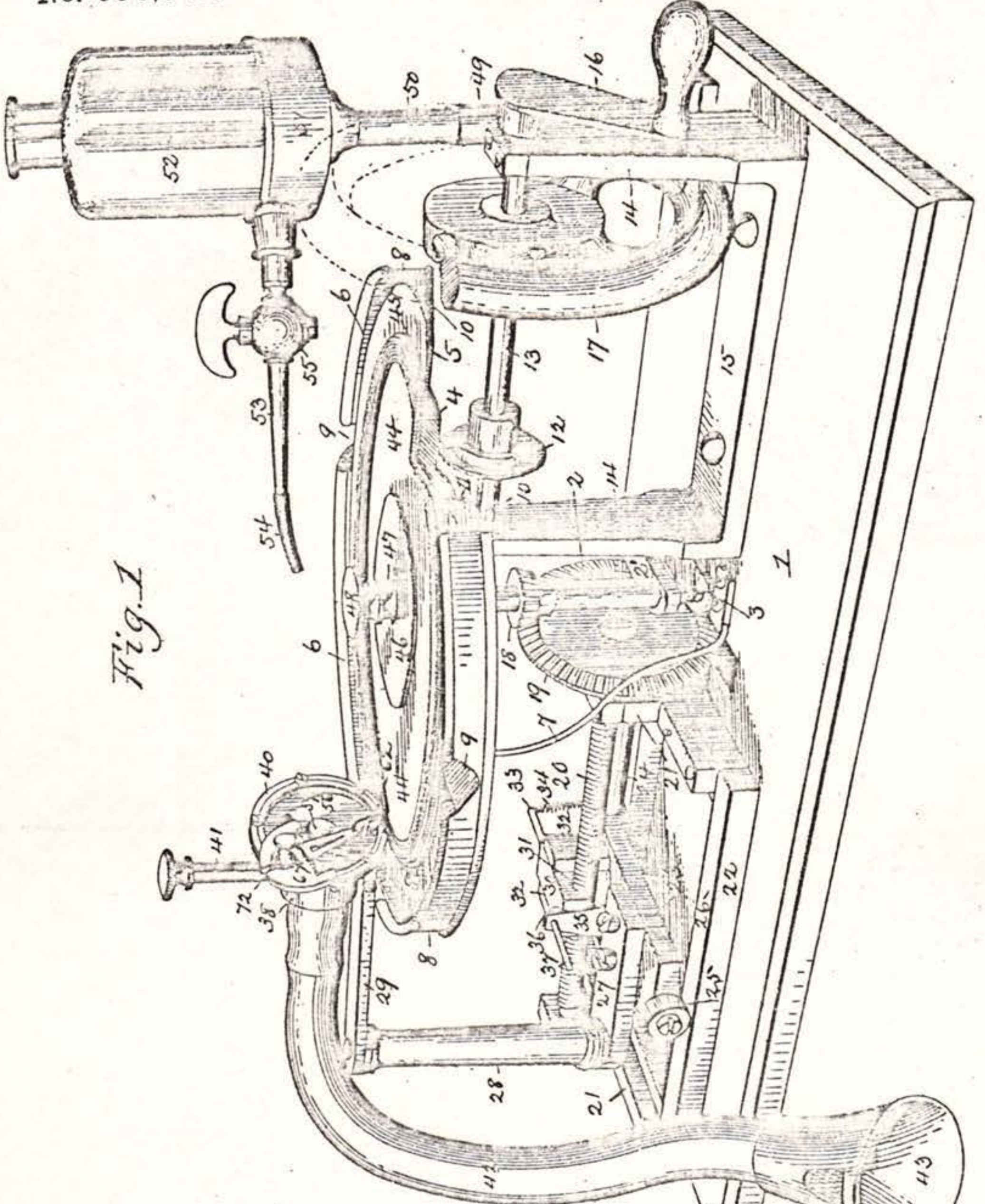


Fig. 1

Witnesses;

Percy C. Bowen

H. T. Chapman

Inventor:

Emile Berliner,

By Joseph Lyons.

Attorney.

(No Model.)

4 Sheets—Sheet 2.

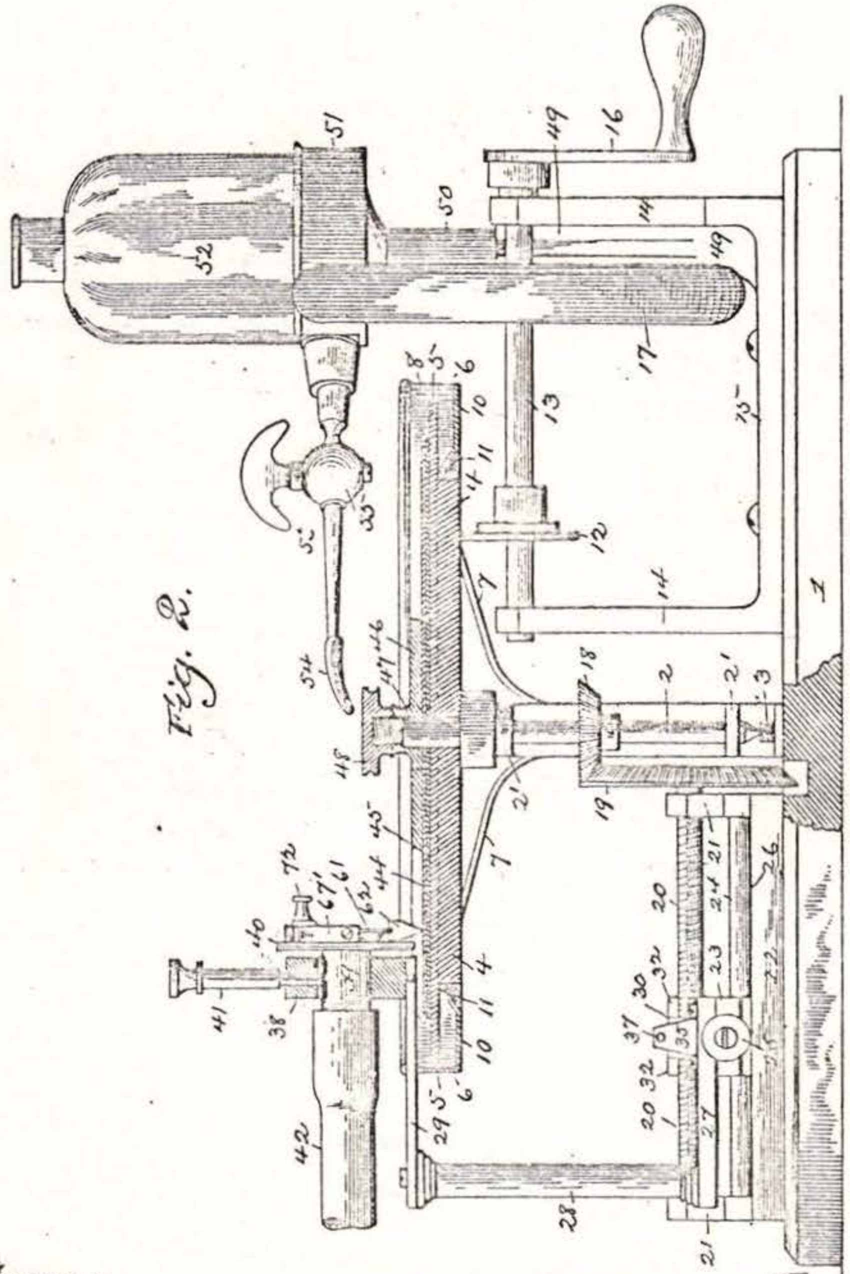
E. BERLINER.

GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

Fig. 2.



Witnesses:
J. B. McGirr.
F. T. Chapman

Inventor.
Emile Berliner,
By Joseph Lyons
Attorney

(No Model.)

4 Sheets—Sheet 3.

E. BERLINER.

GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

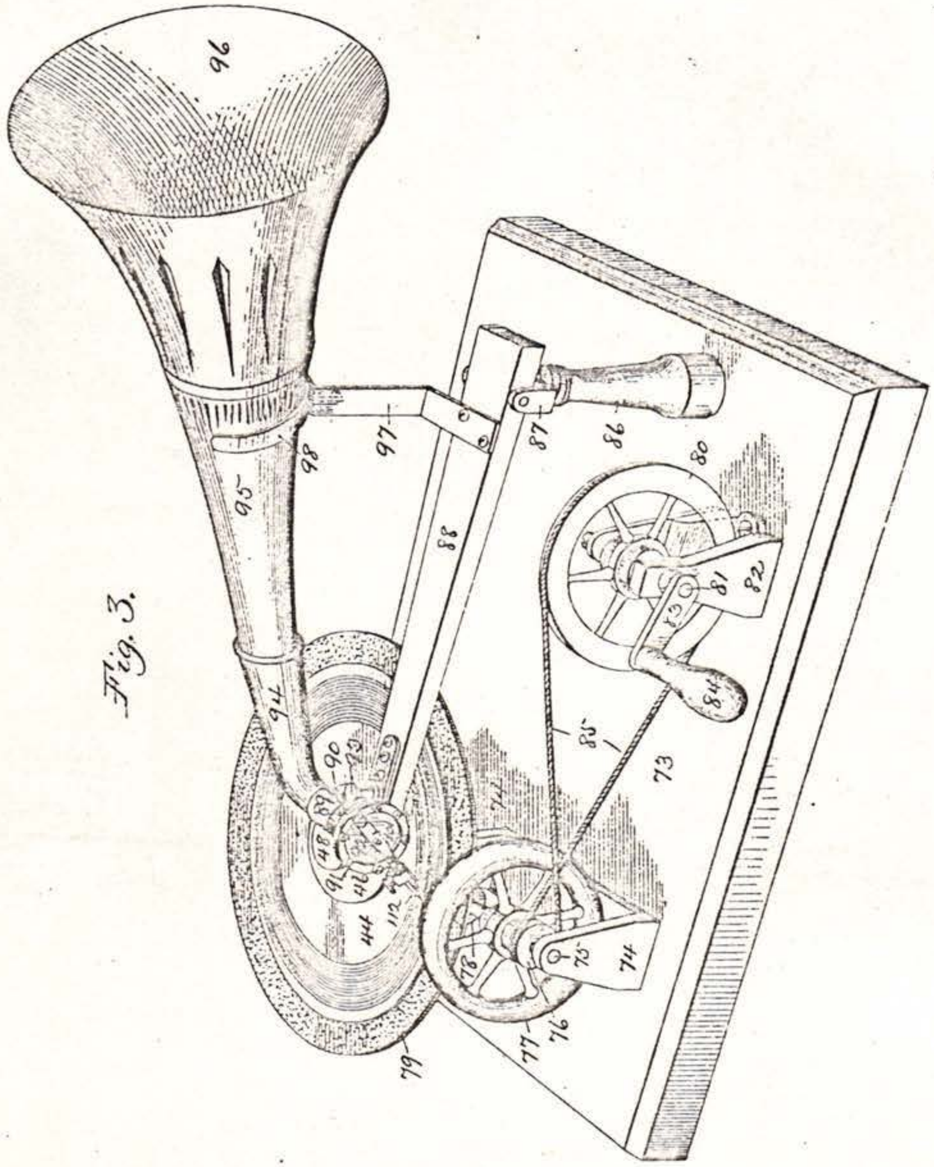


Fig. 3.

Witnesses:

Percy C. Bowen.
F. T. Chapman

Inventor:

Emile Berliner,

By Joseph Lyons.
Attorney.

(No Model.)

4 Sheets—Sheet 4.

E. BERLINER.

GRAMOPHONE.

No. 534,543.

Patented Feb. 19, 1895.

Fig. 4.

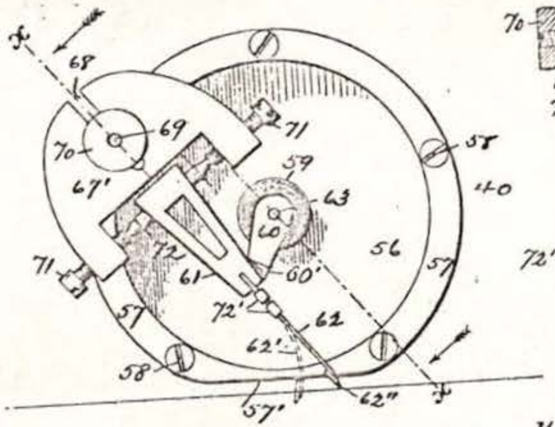


Fig. 5.

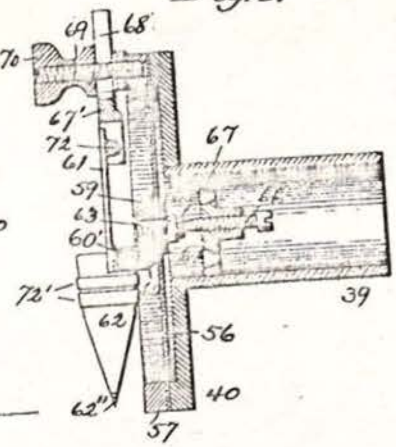


Fig. 6.

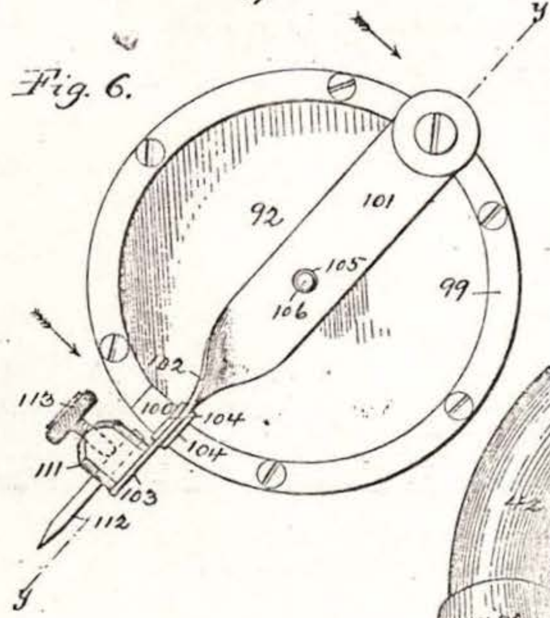


Fig. 7.

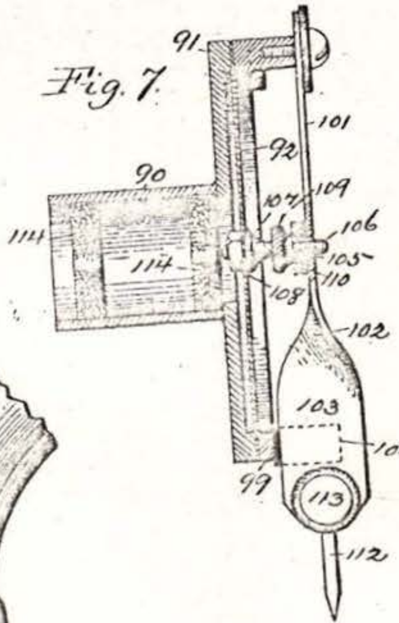
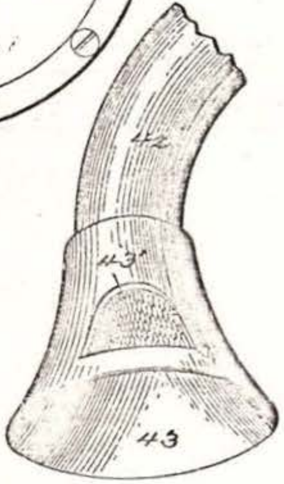


Fig. 8.



Witnesses;

Percy C. Bowen.
H. T. Chapman

Inventor;
Emile Berliner,
By Joseph Lyons.
Attorney.

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO THE UNITED STATES GRAMOPHONE COMPANY, OF SAME PLACE.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 534,543, dated February 19, 1895.

Application filed March 30, 1892. Serial No. 427,080. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, and a resident of Washington, District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

My invention has reference to improvements in the method of and apparatus for recording and reproducing sounds, the improvements being more particularly directed to the construction of that kind of sound recording and reproducing apparatus which I have called "gramophone," and for which Letters Patent of the United States No. 382,790, dated May 15, 1888, have been granted to me.

One feature of my invention has reference to improvements in the method of recording sound by tracing upon a fatty film deposited upon a metallic surface, undulatory lines, corresponding to sound waves, and then etching such lines in the metal base, or as it is now commonly called, the record tablet; while the other features of my invention have reference to the construction of the details of both the recorder and the reproducer of the gramophone. Each of these features of improvement are designed to overcome certain difficulties, and to avoid certain imperfections heretofore met with in the operation of the gramophone. These difficulties and imperfections, and the manner in which they are avoided, will be particularly pointed out in the following detailed description with reference to the accompanying drawings, in which—

Figure 1, is a perspective view of my improved gramophone recorder. Fig. 2 is a side elevation, partly in section, of the recorder. Fig. 3 is a perspective view of a gramophone reproducer. Fig. 4, is an elevation of a recording diaphragm and stylus. Fig. 5, is a section of the same on the line x—x of Fig. 4. Fig. 6, is an elevation of the gramophone reproducing diaphragm and stylus. Fig. 7, is a section of the same on line y—y of Fig. 6, and Fig. 8, is a perspective view of an improved mouth-piece for the recorder.

Like numerals of reference indicate like parts throughout the drawings.

My improved gramophone recorder is shown as a whole in Figs. 1 and 2, mounted upon a suitable base 1. About midway of the length of this base there is an upright shaft 2, journaled in brackets 2′, 2′, stepped at its lower end in a suitable bearing 3. This shaft carries at its upper end a circular disk 4, the outer or peripheral portion of which is reduced in thickness as shown at 5, and this reduced portion extends over a ring shaped pan 6, supported by stays or brackets 7, from which it may be lifted and removed, when required. The outer edge or wall 8, of the pan is of sufficient height to project for a distance above the disk 4, and is provided with pouring lips 9, for a purpose hereinafter described. The bottom 10 of the pan extends under the reduced portion 5, of the disk 4, and its inner edge 11, is upturned close to the under side of the reduced portion of the disk, as shown.

Bearing against the under side of the disk 4, is a friction wheel 12, secured to a horizontal shaft 13, which latter is journaled in the upper ends of posts or uprights 14 constituting the ends of a frame, the base 15, of which is secured to the base 1 of the apparatus. The position of shaft 13, and the diameter of the friction wheel 12, are such, that a portion of the weight of the disk 4, and of its shaft 2, is supported by the friction wheel; whereby the bearing 3, is relieved from a portion of that weight, and whereby frictional gearing between the disk 4 and wheel 12 is insured, without requiring special adjustment. The shaft 13, carries at its outer end a crank 16, by means of which it is rotated, and between the two uprights 14, there is secured to the shaft a heavy fly or balance wheel 17. Secured to the upright shaft 2, below the disk 4, there is a beveled pinion 18, meshing with a large bevel gear 19, on one end of a horizontal screw-threaded shaft 20, which is arranged radial to the disk 4, and journaled adjacent to the said gear 19, and also at the other end, in pillow-blocks 21, supported on the end piece of a rectangular frame 22, which in turn is fast on the base 1. Mounted upon the frame 22, so as to be movable thereon in the direction of the length of the shaft 20, there is a carriage 23, supported at one end by a guide rod 24, on which it is free to slide, and at the other end by a roller 25, movable along the upper surface 26, of one of the side pieces of the frame 22. The carriage 23, has firmly secured to it a projecting arm 27, on the outer end of which is an upright post 28, carrying at its upper end an arm 29, parallel with the arm 27, and of such length as to overhang the disk 4, when the carriage is moved to the right, as represented in the drawings; the construction being such, that when the carriage 23 is moved in the manner to be described, the arm 29, will be carried radially over the disk 4, and any object carried thereby will participate in said movement.

The carriage 23, is moved in one direction by means of the screw-threaded shaft 20, and in order to effect this operation, there is provided a block 30, in one side of which, near one end, is formed a half nut 31, constructed to engage the threads on the shaft 20; and this block 30, is pivotally supported between ears 32, erected on the carriage 23. Projecting from the other end of the block 30, there is a pin 33, to which one end of a spring 34, is attached, the other end of said spring being secured to the carriage 23, and the tendency of the spring is to maintain the block 30, in a tilted position with the nut portion raised out of engagement with the shaft 20. In order to lock the block 30, in engagement with the shaft 20 there is provided a leaf spring 35, mounted on the carriage 20, opposite the free end of the block 30, and having on its free end a tooth 36, which passes over the top of the hinged block 30, when the nut formed in the same is in engagement with the screw threads on the shaft 20, the tendency of the leaf spring 35, being to move inwardly toward the block 30. This catch spring 35, is also provided with a pin 37, which serves as a handle for withdrawing the catch so as to unlock the block 30, and thereby allow the carriage 23 with its appurtenances to be freely moved to any position upon the frame 22.

To the free overhanging arm 29, is secured a ring sleeve 38 which receives the neck 39, projecting on one side from the frame 40, in which latter the recording diaphragm and stylus are mounted, and this neck 39, with its appurtenances is fixed in any desired position in the ring frame 38, by a clamp screw 41. The free end of the neck 39, projects beyond the ring frame 38, and receives the sound conveying tube 42, which is preferably made flexible, and which has at its free end a mouth-piece 43, the particular construction of which will hereinafter be more fully described.

The disk 4, which is in the nature of a rotary table, has hereinbefore been described and is shown in the drawings as reduced in thickness on that portion of the periphery which overlaps the inner wall of the pan 6, and if this construction is used, the disk 4, must be removable from the shaft 2. It is, however, also practicable to make the disk or revolving table, in two parts, the lower part of which extending only to within a short distance of the upper edge of the inner wall 11. of the pan, while the upper part extends over that edge to within a short distance of the outer wall of the pan. This is indicated by a dotted line in Fig. 2, and if this construction is adopted, only the upper thinner part of the table is removable from the upright shaft 2, while the lower thicker part of the table may be fixed to that shaft.

When a sound record is to be made, a record tablet of the kind described in my aforesaid Letters Patent, is placed upon the rotary table 4, and this record tablet is represented in the drawings as a circular disk 44, which has a central perforation passing over the upper end of the shaft 2. Sometimes it is convenient to interpose between the record tablet and the rotary supporting table a thin disk 45, of felt, or of some other non-resonant material. This, however, is not essential. Upon the record tablet is placed a clamping plate 46, which by preference is provided with a hub 47, which is slipped over the upper end of the shaft 2. This upper end of the shaft 2, is screw-threaded as shown, and a thumb-nut 48, is then screwed down upon the hub of the clamping plate, whereby the record tablet is securely fastened in position.

At one end of the base plate 1, there is mounted a standard 49, which may be a split tube as shown, and in which is supported by friction a stem 50, projecting from the bottom of a shelf 51, and which in turn supports a vessel 52, containing alcohol. From the bottom of this vessel extends a tube 53, preferably provided at its free end with a flexible nozzle 54; and a stop-cock 55, with which the tube is provided permits the operator to regulate the flow of alcohol from the nozzle. With my present improvement it is necessary that during the whole process of tracing the record, the record tablet be covered with a film of alcohol, and for this purpose a thin stream of alcohol is directed upon the center of the tablet, or rather upon the clamping plate 46, from which the alcohol spreads in all directions by centrifugal force, and flows over into the pan 6. When the tracing of the record has been completed, the clamping plate is removed and the record tablet also is lifted from its support by the insertion between the same of a sharp edge, such as a knife blade, or even by the finger nails of the operator, and is removed for further manipulation as described in my aforesaid Letters Patent, and also for the manipulation which will be described hereinafter.

Only a very small quantity of alcohol is used for producing a single record, but after continued use of the machine a considerable amount of alcohol accumulates in the pan, and this is removed by removing the table 4, or the upper, thinner part thereof, as the case may be, by inserting a finger in each of the pouring lips 9, and thus lifting the disk or table 4, from the shaft 2. The pan is then removed from the bracket 7, and the alcohol is poured out and preferably back into the vessel 52, by one of the pouring lips.

The recording diaphragm 56, is mounted in the circular frame 40, between a ledge formed on said frame and an annulus 57, screwed down upon the same by screws 58, as shown, or in any other suitable manner. On the rear side of that diaphragm there is applied a small block 59, of hard rubber from which extends radially an arm 60, which at its free end is turned up at right angles, outwardly and into contact with the lever 61, which carries the recording stylus 62.

The block 59, is fastened to the center of the diaphragm by a screw 63, passing through the diaphragm and through a washer 64, applied to the front side of the diaphragm. The head of this screw is faced with a disk 65, of soft rubber, and against the same bears the point of an adjusting screw 66, which is mounted in a perforated disk or spider 67, fixed in the neck 39.

The lever 61 is mounted on a plate 67′, formed with a slot 68, through which a set screw 69, fixed in the annulus 57, passes. The plate 67′, can thus be adjusted to various positions on the annulus, and is clamped in the adjusted position by a thumb-nut 70. One end of the plate 67′ is bifurcated, and screws 71, 71, passing through the legs of the fork, are formed at their ends with bearings for the pivot points of the arbor 72, which is fixed to the lever 61. This lever, is made as light as practicable and as is consistent with rigidity, and the plate 67′, together with the lever 61, which it carries, is so adjusted that the upturned end of the arm 60, bears upon the lever at the greatest practicable distance from the axis of the spindle 72, viz: at the free end of the lever. The connection between the lever and the upturned end of the arm 60 is made by a small quantity of pitch, 60′, which acts as an efficient cement, and which is applied after the lever has been adjusted to its proper position. This mode of connecting the lever with the arm 60, and thereby with the diaphragm, I have found to be of great advantage for a variety of reasons, but more especially on account of the ease with which the connection is made, and unmade in case of repair, and on account of the damping effect it has upon the lever.

To the end of the lever 61, is secured the recording-stylus 62, by soldering or otherwise, with its plane at right angles to the plane of the lever, as shown. The stylus is composed of a flat, and rather thin plate of spring steel, pointed at its free end, and provided with a tracing point 62″, of iridium. The broad portion of the stylus is damped by one or two bands 72′, of soft rubber, which are simply slipped over the same.

By reference to Fig. 4, it will be seen that the lever 61, with the recording stylus 62 extend across the diaphragm upon a line which constitutes a chord but not a diameter of the circle of the diaphragm. They are, therefore, eccentrically mounted with reference to the center of the diaphragm; but notwithstanding this eccentric location, the lever is rigidly connected with the center of the diaphragm and thus receives the maximum amplitude of its vibration. By thus placing the lever with the stylus eccentric with reference to the center of the diaphragm both the lever and the stylus may be and are made shorter than if they were located on the line of a diameter of the diaphragm. This is an important result, since the shorter the lever and stylus, the less liability there is of lost motion, and the less liability there is of extra or spontaneous vibrations of the lever and stylus, and both of these facts conspire to produce an accurate tracing of the sound waves impinging against the diaphragm.

Where the stylus passes over the edge of casing 40, the latter, together with the annulus 57, is cut away upon a straight line, as indicated at 57′. This permits a further reduction of the length of the stylus, since the record tablet may be located close to the straight edge 57′.

The body of the stylus is normally curved downwardly, as shown in dotted lines at 62′, but when the diaphragm holder or frame 40, is turned to cause the stylus to impinge upon the record tablet, which is the preparatory step for making a record, the stylus is unbent and becomes straight, as shown in solid lines in Fig. 4, and I have found that the best results are obtained when the stylus is at an angle of about forty-five degrees with the plane of the tablet. The maximum pressure of the stylus upon the record surface is therefore equal to the force required to unbend the stylus. It is very small, because the stylus is made as thin as practicable, and it is uniform for different records and for all parts of the same record.

The mouth-piece, into which vocal sounds are uttered for recording, is shown at 43, in Figs. 1 and 8, and it consists of a bell shaped structure, the small end of which is secured to the sound conveying tube, while the wide, flaring end is turned toward the speaker who applies his mouth to the opening. Near the edge of the mouth opening there is a perforation 43′, cut into the wall of the mouth-piece, and this perforation is of such shape and size, and at such distance from the edge of the mouth-piece, as to fit approximately the edge of the nose of the speaker; so that when the mouth-piece is applied, the sounds uttered by the mouth enter the wide, flaring opening, while the sounds uttered by the nose enter the perforation 43′.

In making a record of vocal sounds, it is necessary that all sound waves composing the words or the song be conveyed to the diaphragm, and it has, therefore, been proposed to make mouth-pieces of such size and shape as to admit within the opening both the mouth and the nose of the speaker or singer, and to fit against the face of the user around the mouth and nose. Mouth pieces of this character are necessarily large and clumsy, and do not readily and comfortably fit different persons, while with my construction the size of the mouth-piece is reduced, and will comfortably fit different speakers.

By means of the apparatus so far described, a record of sound waves is made in the following manner: The spring catch 35, 36, is drawn back, which permits the spring 34, to lift the block 30, from the screw 20, so that the carriage 23, may be freely moved to the left, whereby the stylus 62, is carried beyond the edge of the rotary table 4. A record tablet prepared in the manner described in my aforesaid Letters Patent is then placed upon the table 4, and clamped to the same, as hereinbefore described, and the carriage 23, is moved toward the right until the point of the recording stylus is above the tablet but within the edge of the same. The casing 40, is then turned in its bearing 38, until the point of the stylus impinges upon the tablet and is unbent, as shown in Fig. 4. In this position the casing 40, is clamped by means of the screw 41. The stop-cock 55, is then opened and a thin stream of alcohol is directed upon the clamping disk 46. The wheel 17, is now rotated by means of the crank and handle 16, whereby, by means of the gearing described, the record tablet is rotated, while the stylus is carried across the face of the tablet in a radial line, removing from the tablet a fine spiral line of the fatty etching ground with which it had been covered. Sound waves are now directed against the diaphragm in any desired manner, and if vocal sounds are to be recorded, the sound conveying tube 42, with the mouth piece 43, will be used. The vibrations of the diaphragm thus produced will cause the stylus to make a tracing of an undulatory line, corresponding to the sound waves directed against the diaphragm; all as described in my aforesaid Letters Patent. During this whole time a thin stream of alcohol is delivered upon the plate 46, and the alcohol spreading out in all directions is maintained as a uniform and constantly renewed film upon the tablet. In this manner every part of the record is made under alcohol, and in this respect my present invention differs from the process set forth in my aforesaid Letters Patent.

In accordance with the said patent, alcohol is poured once for all over the tablet, and is allowed to evaporate during the process of recording. I have found that in this manner it often happens that the alcohol has entirely evaporated before the record is completed, so that a portion of the latter is made upon a dry tablet; whereby the accumulation of filamentary particles of dust on the point of the stylus, which the alcohol is designed to avoid, takes place during the production of a portion of the record. With my present improvement this defect is cured, since it maintains the record tablet moist with alcohol from the beginning to the end of the operation.

After the tracing of the record has been completed, the tablet is speedily removed and before the record is fixed by etching as described in my aforesaid patent, the alcohol adhering to the record surface is quickly washed off with water. This is an important step in my improved process and greatly improves the definition of the record by etching. The reason for this is, that the alcohol slightly attacks and dissolves the fatty etching ground, so that the thin film of alcohol remaining upon the tablet, contains a slight quantity of that ground in solution. If now, the film of alcohol is allowed to evaporate an exceedingly small quantity of the dissolved ground is deposited upon the metal which has been laid bare by the stylus. This small deposit of ground sufficiently resists the action of the etching fluid to impair the definition of the final record. By simply pouring water over the record surface immediately after the tablet has been removed from the recording apparatus the film of alcohol and the ground held in solution by the same is removed, and the tracings of the stylus present a clean metallic surface, which is properly attacked by the etching fluid.

The reproducing apparatus as a whole is represented in Fig. 3.

Upon a base board 73, in standards 74, is journaled a shaft 75, upon which are mounted a driven pulley 76, a fly-wheel 77, and a friction disk 78. The latter is in frictional engagement with a rotary table 79, which is mounted upon a vertical shaft substantially in the manner described with reference to the rotary table 4, of the recording apparatus. Fig. 3, being a perspective view, the mounting of the table 79, is not visible, but is easily understood from the foregoing description. The upper surface of the table is preferably covered with a sheet of felt or other elastic and non-resonant material, as indicated by appropriate shading.

Upon the felt covered table 79, the record tablet 44, is placed and is clamped thereon substantially in the manner in which this is done in the transmitting apparatus, *i. e.*, by means of a clamping plate 46, and a thumbnut 48. A driving wheel 80, mounted on a shaft 81, which is journaled in standards 82, is rotated by means of a crank 83, and handle 84, and gives motion to the table 79, by means of a crossed belt or cord 85. The relation of the table 79, to the friction disk 78, is the same as the relation of the table 4, to the friction disk 12; that is to say, the table rests with the greater part of its weight upon the friction disk, so that the frictional gearing is automatically maintained. A post 86, mounted upon the base-board 73, has swiveled upon its upper end a fork 87, between the prongs of which is pivoted the swinging arm 88, which extends over the table 79, and has at its free end a clasp 89, which receives the neck 90, which projects from the center on one side of the casing 91, of the reproducing diaphragm 92. This casing with its diaphragm, stylus and appurtenances, which will presently be described, can be thus turned in the clasp, and can be fixed in any adjusted position by a clamp screw 93.

Upon the end of the neck 90, which projects beyond the clasp 89, is slipped a flexible tube 94, which in turn receives the small end of a sound conveying trumpet 95, the flaring end 96 of which is turned toward the listener. A bracket 97, secured to the swinging arm 88, carries at its free end an elastic fork 98, which receives and supports the trumpet, and the parts are so proportioned that the free end of the swinging arm preponderates, so that the point of the reproducing stylus, which will presently be described, presses rather firmly upon the record tablet.

It will now be understood, that when a record tablet, having a record of sound waves upon its surface, produced in accordance with my invention, is mounted upon the table 79, and when the point of the stylus is adjusted in engagement with the record groove, and the wheel 80, is rotated, the rotating record groove will guide the stylus across the face of the tablet, and will at the same time vibrate the stylus and diaphragm in accordance with the undulations of the record groove. The sound waves thus produced by the diaphragm will issue from the flaring opening of the trumpet, and the sounds will be heard by a listener in front of the trumpet, or in its vicinity.

The reproducing diaphragm is mounted in the casing 91, in the usual manner, being held against a ledge by means of an annulus 99. On this annulus is formed a swelling or block 100, and diametrically opposite to the same the stylus carrying spring 101, is fastened to the annulus, and extends across the face of the diaphragm and beyond the edge of the annulus. This spring 101, is a leaf spring which faces with its flat side the face of the diaphragm up to a point, beyond the center of the latter, and is then twisted at right angles, as indicated at 102, and crosses the annulus edgewise as shown at 103. The tendency of the part 101, of the spring is to press toward the diaphragm, whereby the edge of the part 103, is made to bear with some force upon the annulus 99; and the tendency of the part 103, is to press against the swelling or block 100. The spring is therefore elastic in two directions at right angles to each other.

In order to prevent grinding of the spring against the annulus and against the block 100, a U-shaped piece 104, of soft rubber embraces the outer portion 103, where it bears upon the annulus and against the block. This soft rubber cushion also serves as a dampener for the spring. At the point where the spring passes over the center of the diaphragm, it has a perforation 105, and a screw pin 106, secured to the center of the diaphragm by two nuts 107, 108, extends loosely through the perforation. A thumb-nut 109, also placed on the screw-pin 108, and a soft rubber washer 110 between the thumb-nut and the spring serve to regulate the tension of the latter and of the diaphragm, as will be readily understood.

On the free end of the spring 101, 103, there is secured a binding post 111, in which the stylus 112, is held by the set screw 113, and may be adjusted to project to the required distance beyond the end of the spring. This stylus is preferably made of hard steel. It has a slender point, but the point should not be so sharp as to cut the bottom of the record groove which it engages.

In the operation of reproducing the sounds recorded on a tablet, the stylus is guided by the walls of the record groove, and not by the bottom of the same. Consequently it is not essential that the point of the stylus be in contact with the bottom of the groove. In fact it is preferably not in contact with the same, so that this point may be made rather dull.

The sounds emitted by the reproducing diaphragm are very powerful and ordinarily too loud to be received with comfort by a listener in front of the trumpet or other receiving tube. For this reason I have found it sometimes necessary, to reduce the volume of the emitted sound before it reaches the ear, and this I accomplish by one or more perforated and exchangeable diaphragms 114, placed in the neck 90. These diaphragms should be made of some non-resonant material like soft rubber, or cork, as indicated by appropriate shading.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. The method of recording vocal and other sounds which consists in removing from a record tablet covered with a fatty film, undulatory lines of said film by, and in accordance with the sound waves and maintaining at the same time a layer of a fluid over the film, substantially as described.

2. The method of recording vocal and other sounds upon a rotating disk covered with a fatty film which consists in spreading over said film and continuously renewing over the same a layer of a fluid and at the same time removing from said tablet undulatory lines of the fatty film by and in accordance with the sound waves, substantially as described.

3. The improvement in the art of making a gramophone record which consists in immersing and maintaining the tablet and the point of the recording stylus in alcohol during the process of recording, substantially as described.

4. The improvement in the art of making and fixing a gramophone record which consists in removing from a tablet covered with a fatty film undulatory lines of said film by and in accordance with sound waves while said film is covered with a layer of alcohol; then immediately removing the alcohol with water and then subjecting the tablet to the

action of an etching fluid, substantially as described.

5. The method of reproducing sounds from a record of the same which consists in vibrating a stylus and propelling the same along the record by and in accordance with the said record, substantially as described.

6. In a gramophone, a recording stylus pressing by its own elasticity upon the record tablet at right angles to the plane of its vibratory movements and consisting of a leaf spring terminating in a point of harder material than that of the body of the stylus, substantially as described.

7. In a gramophone, the combination of a sound receiving diaphragm and an elastic recording stylus controlled by the diaphragm and adjustable with reference to a record tablet so as to press by its own elasticity upon the same at right angles to the plane of its vibratory movements, substantially as described.

8. In a gramophone a recording stylus pressing by its own elasticity upon the record tablet at right angles to its plane of vibratory movements, and consisting of a leaf spring terminating in an iridium point, substantially as described.

9. In a gramophone, a recording stylus composed of a leaf spring terminating in a tracing point in combination with one or more elastic non-sonorous dampers, substantially as described.

10. In a gramophone a recording stylus formed of a leaf spring terminating in a tracing point in combination with one or more sleeves of soft rubber upon the leaf spring for damping the same, substantially as described.

11. In a gramophone, the combination of a sound receiving diaphragm, a lever and a recording stylus carried by the same, both extending parallel but eccentrically over the diaphragm; with a connection between the center of the diaphragm and the lever, substantially as described.

12. In a gramophone, the combination of a sound receiving diaphragm a lever and a recording stylus carried by the same, both extending over the face of the diaphragm but eccentrically thereto, with a rigid connection between the center of the diaphragm and the free end of the lever, substantially as described.

13. In a gramophone, the combination of a circular sound receiving diaphragm, a lever and an elastic recording stylus both extending parallel with the diaphragm on the line of a chord, with a rigid connection between the center of the diaphragm and the free end of the lever, substantially as described.

14. In a gramophone, the combination of a sound receiving diaphragm, a lever and an elastic stylus carried by the same, both extending parallel, but eccentrically thereto; with a bracket rigidly connected with the center of the diaphragm and removably cemented to the lever, substantially as described.

15. In a gramophone, the combination of a sound receiving diaphragm mounted in a suitable frame, a bracket adjustably mounted on said frame, a lever pivoted in said frame extending parallel to and eccentrically with reference to the center of the diaphragm, and an elastic recording stylus carried by the lever; with a mechanical connection between the center of the diaphragm and the free end of the lever, substantially as described.

16. In a gramophone a sound receiving diaphragm and a tube for conveying sound waves thereto in combination with a recording stylus receiving motion from the diaphragm, and a screw mounted in the sound conveying tube bearing centrally upon the diaphragm for adjusting the tension of the latter, substantially as described.

17. In a gramophone, the combination of a horizontal rotary table adapted to support a record tablet, and a vertical shaft free to move longitudinally, carrying the table; with a friction disk engaged by the under side of the table for rotating the latter, substantially as described.

18. In a gramophone the combination of a horizontal rotary table mounted upon a vertical shaft and adapted to support a record tablet; with a friction disk engaging the under side of the table and partly sustaining the weight of the table, whereby the latter is automatically maintained in frictional gear with said disk, substantially as described.

19. In a gramophone, the combination of a rotary horizontal table adapted to receive and support a flat record tablet; with a reservoir of a suitable fluid, such as alcohol, discharging upon the center of the table and tablet, and an annular pan disposed underneath the table for receiving the overflow of alcohol, substantially as described.

20. In a gramophone the combination of a horizontal rotatable table adapted to receive and support a record tablet; with a reservoir of alcohol discharging upon the center of the table and tablet, an annular pan disposed under the edge of the table for receiving the overflow of alcohol, and a friction disk bearing upon the under side of the table between the center of the same and the inner wall of the pan, substantially as described.

21. In a gramophone, the combination of a horizontal rotary table adapted to receive and support a record tablet, a recording diaphragm and stylus connected by gearing with the table to move radially over and with the stylus in operative relation to the same, substantially as described.

22. In a gramophone, the combination of a horizontal rotating table adapted to receive and sustain a flat record tablet, with a carriage movable in a line parallel to a radius of the table, a recording diaphragm and stylus carried by the carriage with the stylus in operative contact with the record tablet, and

gearing connecting the table with said carriage, substantially as described.

23. In a gramophone, a sound conveying tube provided with a mouth piece having a flaring opening for the application of the mouth of the speaker and a perforation in the side wall of the mouth piece separated from and spaced with reference to the mouth opening and shaped to correspond to the shape of the nostrils of the speaker, substantially as described.

24. In a gramophone a sound reproducing diaphragm in combination with a stylus lever extending diametrically across the same, and elastic in two directions at right angles to each other, substantially as described.

25. In a gramophone, the combination of a diaphragm and a stylus carrier composed of a leaf spring twisted at one point so as to bring the edge of one portion at right angles to the face of the other portion, whereby it is elastic in two directions, substantially as described.

26. In a gramophone the combination of a reproducing diaphragm and stylus; with a stylus carrier composed of a leaf spring extending flat-wise over the face of the diaphragm and edgewise over the edge of the diaphragm, substantially as described.

27. In a gramophone the combination of a reproducing diaphragm mounted in a suitable frame the latter being provided at one point with a boss or stop; with a double elastic stylus carrier composed of a twisted leaf-spring tending toward the diaphragm and against the boss or stop, substantially as described.

28. In a gramophone, a reproducing diaphragm and stylus in combination with an elastic stylus carrier extending over the face of the diaphragm and tending toward the same, of an adjustable connection between the diaphragm and stylus carrier and adjustable for varying the pressure between diaphragm and style carrier, substantially as described.

29. In a gramophone the combination of a reproducing diaphragm mounted in a suitable frame provided with a boss or stop; with a double elastic stylus carrier tending toward the diaphragm and toward the stop, and elastic non-resonant dampers interposed between the style carrier and the diaphragm and between the style carrier and the frame and stop, substantially as described.

30. In a gramophone a sound reproducing diaphragm and a sound conveying tube for the same, with one or more non-resonant perforated diaphragms in the said tube for reducing the volume of sound conveyed to the ear substantially as described.

31. In a gramophone a recording stylus pivoted to move in response to the vibrations of a diaphragm and elastic in a plane at right angles to such motions, substantially as described.

32. In a gramophone, a reproducing stylus having a wedge-shaped point engaging the walls of the record groove, substantially as described.

33. In a gramophone reproducer, a stylus carried or formed by a spring fixed at one end to the diaphragm holder and freely extending across and beyond the same and operatively connected with the center of the diaphragm, substantially as described.

34. In a gramophone reproducer, a spring constituting or carrying a stylus, fixed at one end to the diaphragm holder and extending across and beyond the periphery of the same and freely pressing against the diaphragm, substantially as described.

35. In a sound reproducing apparatus consisting of a traveling tablet having a sound record formed thereon and a reproducing stylus shaped for engagement with said record and free to be vibrated and propelled by the same, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:
HENRY E. COOPER,
F. T. CHAPMAN.

(No Model.)

E. BERLINER.

SOUND RECORD AND METHOD OF MAKING SAME.

No. 548,623. Patented Oct. 29, 1895.

Fig. 1.

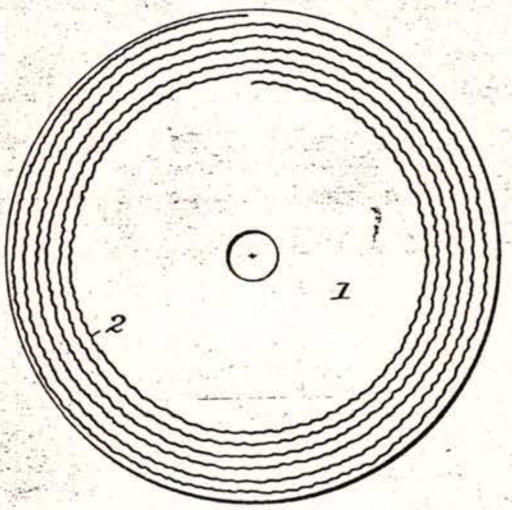
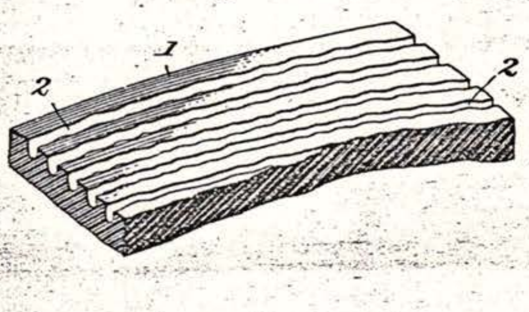


Fig. 2.



Witnesses
Jno. G. Hinkel.
F. T. Chapman

Inventor,
Emile Berliner,
By Joseph Lyons
Attorney

ANDREW B. GRAHAM, PHOTO-LITHO. WASHINGTON, D.C.

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

SOUND-RECORD AND METHOD OF MAKING SAME.

SPECIFICATION forming part of Letters Patent No. 548,623, dated October 29, 1895.

Application filed March 18, 1893. Serial No. 466,708. (No model.)

Correction in Letters Patent No. 548,623.

It is hereby certified that in Letters Patent No. 548,623, granted October 29, 1895, upon the application of Emile Berliner, of Washington, District of Columbia, for an improvement in "Sound-Records and Methods of Making Same," an error appears in the printed specification requiring correction, viz: In line 50, page 1, the word "cast" should read *coat;* and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed, countersigned, and sealed this 26th day of November, A. D. 1895.

[SEAL.]

JNO. M. REYNOLDS,
Assistant Secretary of the Interior.

Countersigned:
JOHN S. SEYMOUR,
Commissioner of Patents.

The sound-records of the gramophone are generally zinc disks into which a spiral record of sound-waves is etched. Other substances than zinc capable of being etched into may of course be used.

The simplest way for making a duplicate copy of such a record is to impress it in wax, deposit copper thereon, and detach the copper shell. This is the well-known method used by electrotypers. There is, however, a loss in the perfection of the surface, resulting from the fact that electrotypers' wax is porous and uneven of surface, and the resultant copper copy containing the sound-record is not as good in tone quality as the original. It is therefore necessary to deposit a copper or other metallic matrix directly on the original zinc record. This I do by first thinly covering the zinc with a material capable of resisting the action of the sulphate of copper solution usually employed for electro plating or typing, and then deposit copper over that, and when thick enough detach the copper deposit.

My method is to cast the previously-cleaned zinc-record disk in a cyanide-of-copper or cyanide-of-brass solution, electrolytically, by

per matrix with a substance capable of withstanding the sulphur fumes, and I find electrolytically-deposited iron or nickel a proper substance to accomplish the desired effect. The copper matrix is therefore cleaned and placed in a nickel or iron bath, and a thin coating of iron or nickel is deposited on it by an electric current. The matrix thereby becomes protected against sulphur fumes, and iron and nickel being harder than copper the matrix, by being thus coated, becomes more durable, and withstands pressure for a longer period. It is also possible with such a matrix to press unvulcanized rubber into it, vulcanize the rubber while attached to the matrix, and then detach it, when a true copy of the original sound-disk will be the result.

In the annexed drawings, forming part of this specification, there is shown in Figure 1 a plan view of a sound-record made in accordance with the present invention, with the lines representing the record greatly exaggerated; and Fig. 2 is a perspective view of a small portion of a sound-record copy on an enlarged scale.

Referring to the drawings, there is shown a

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA.

SOUND-RECORD AND METHOD OF MAKING SAME.

SPECIFICATION forming part of Letters Patent No. 548,623, dated October 29, 1895.

Application filed March 18, 1893. Serial No. 466,708. (No model.)

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Processes of Making Copies of Sound-Records; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in sound-records and in the method of making the same.

The present invention relates more particularly to the production of copies or duplicates of the flat sound-records as made by gramophone in the manner set forth in Letters Patent granted to me on November 8, 1887, No. 372,786, and on May 15, 1888, No. 382,790.

The sound-records, as is well-known, consists of undulatory grooves of even depth, as distinguished from non-undulatory grooves of varying depth produced by other methods of recording sounds.

The sound-records of the gramophone are generally zinc disks into which a spiral record of sound-waves is etched. Other substances than zinc capable of being etched into may of course be used.

The simplest way for making a duplicate copy of such a record is to impress it in wax, deposit copper thereon, and detach the copper shell. This is the well-known method used by electrotypers. There is, however, a loss in the perfection of the surface, resulting from the fact that electrotypers' wax is porous and uneven of surface, and the resultant copper copy containing the sound-record is not as good in tone quality as the original. It is therefore necessary to deposit a copper or other metallic matrix directly on the original zinc record. This I do by first thinly covering the zinc with a material capable of resisting the action of the sulphate of copper solution usually employed for electro plating or typing, and then deposit copper over that, and when thick enough detach the copper deposit.

My method is to c~~as~~oat the previously-cleaned zinc-record disk in a cyanide-of-copper or cyanide-of-brass solution, electrolytically, by which a very thin film of copper or brass adheres to the zinc. After being thus prepared, the coated zinc disk is placed into a sulphate-of-copper bath and copper deposited on it electrolytically. The deposit when thick enough is then detached and forms an accurate matrix, showing the sound-record of the zinc disk in reverse. This matrix can then be impressed into suitable material and thereby produce exact duplicates of the original record-sheet.

I have found hard rubber and celluloid to be excellent materials from which to make such duplicates. These substances when heated become very soft, and when in this soft state they are impressed with a matrix, such as above described, and are cooled while still under pressure, and the resultant rubber or celluloid sheet retains all the characters of the matrix, and thus forms a copy record of the original zinc disk. In impressing a copper matrix on softened rubber, however, the sulphur fumes which are generated when heating the rubber attack the copper and destroy the smoothness of its surface. I have therefore found it necessary to coat the copper matrix with a substance capable of withstanding the sulphur fumes, and I find electrolytically-deposited iron or nickel a proper substance to accomplish the desired effect. The copper matrix is therefore cleaned and placed in a nickel or iron bath, and a thin coating of iron or nickel is deposited on it by an electric current. The matrix thereby becomes protected against sulphur fumes, and iron and nickel being harder than copper the matrix, by being thus coated, becomes more durable, and withstands pressure for a longer period. It is also possible with such a matrix to press unvulcanized rubber into it, vulcanize the rubber while attached to the matrix, and then detach it, when a true copy of the original sound-disk will be the result.

In the annexed drawings, forming part of this specification, there is shown in Figure 1 a plan view of a sound-record made in accordance with the present invention, with the lines representing the record greatly exaggerated; and Fig. 2 is a perspective view of a small portion of a sound-record copy on an enlarged scale.

Referring to the drawings, there is shown a

Raymond R. Wile Research Library

disk 1, of hard rubber or like material, having in its face an undulatory spiral groove 2 of even depth representing sound-waves.

What I claim is—

1. The process of duplicating flat sound records, which consists in depositing copper or other like metal on an original record, then detaching the copper reverse thus produced and facing the same with a layer of hard metal which is not attacked by sulphur, and then pressing the reverse into temporarily softened hard rubber, substantially as described.

2. The process of duplicating flat sound records, which consists in facing an electro-deposited reverse of a record, with nickel or iron, and then pressing this reverse into hard rubber, substantially as described.

3. As an article of manufacture, a sheet of hard rubber having upon its face an undulatory groove of even depth representing sound waves, substantially as described.

4. As an article of manufacture, a sheet of hard rubber having pressed into its face an undulatory line of even depth representing sound waves, substantially as described.

5. A copy of a flat sound record, which consists of a disk of hard rubber having impressed upon its face the lines representing the record, substantially as described.

In testimony whereof I have affixed my signature in presence of two witnesses.

EMILE BERLINER.

Witnesses:

S. E. YOUNG,

GEORGE SEIDENSPIMER.

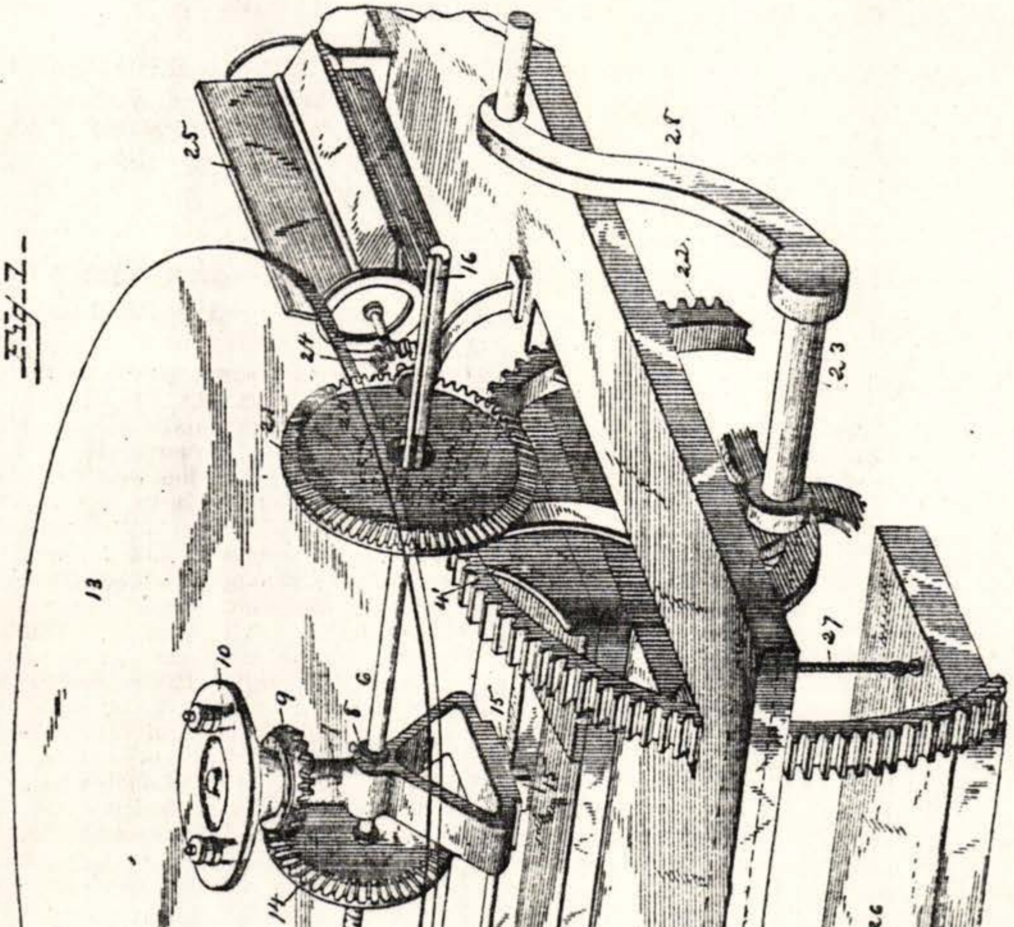
(No Model.) 3 Sheets—Sheet 1.

E. BERLINER.

GRAMOPHONE.

No. 564,586. Patented July 28, 1896.

Fig. 1.



Witnesses

Albert Speiden.

W. Bernhard

Inventor

Emile Berliner,

By his Attorney

Joseph Lyons.

(No Model.)

3 Sheets—Sheet 2.

E. BERLINER.
GRAMOPHONE.

No. 564,586. Patented July 28, 1896.

Fig. 2.

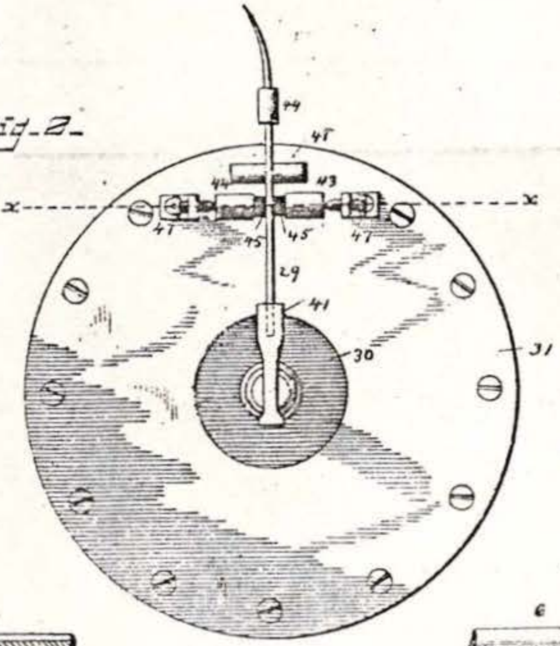


Fig. 6.

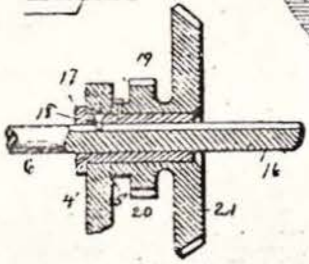


Fig. 7.

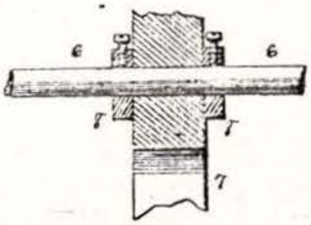


Fig. 4.

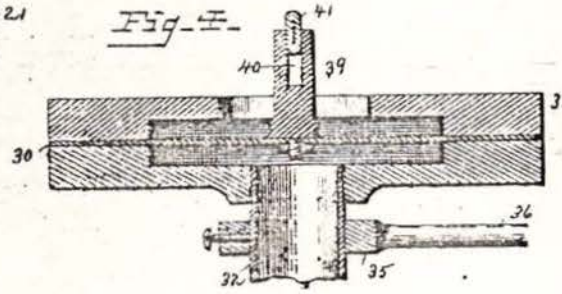
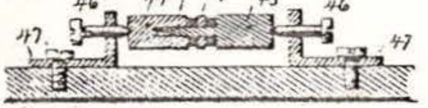


Fig. 5.



Witnesses

Albert Speiden

F. Bernhard

Inventor

Emile Berliner

By his Attorney

Joseph Lyons.

(No Model.)

3 Sheets—Sheet 3.

E. BERLINER.
GRAMOPHONE.

No. 564,586.

Patented July 28, 1896.

Fig. 9.

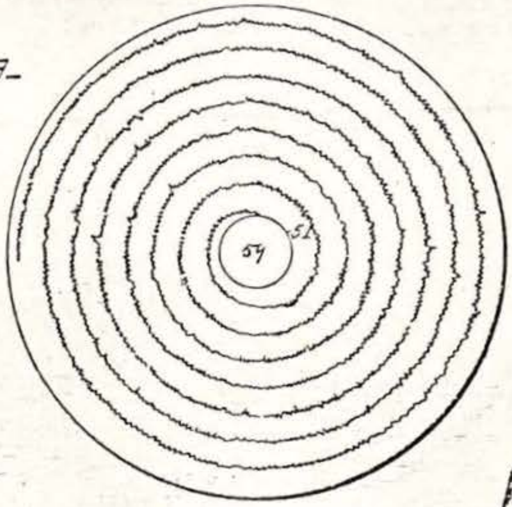


Fig. 8.

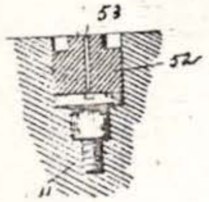


Fig. 10.

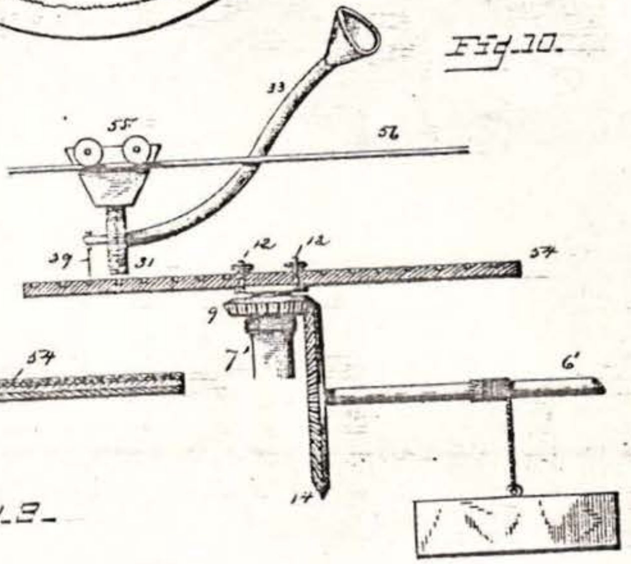


Fig. 11.

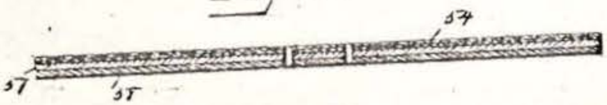
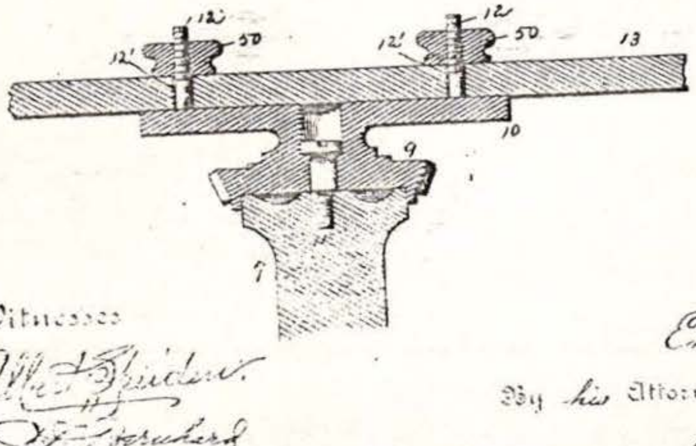


Fig. 3.



Witnesses

Albert Snider.

W. F. Horuherl

Inventor

Emile Berliner.

By his Attorney

Joseph Lyons

UNITED STATES PATENT OFFICE.

EMILE BERLINER, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE UNITED STATES GRAMOPHONE COMPANY, OF WEST VIRGINIA.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 564,586, dated July 28, 1896.

Application filed November 7, 1887. Serial No. 254,541. (No model.) Patented in England November 8, 1887, No. 15,233.

To all whom it may concern:

Be it known that I, EMILE BERLINER, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

My invention has reference to improvements in methods of and apparatus for recording and reproducing spoken words and other sounds, and it is primarily intended as and constitutes an extension and improvement of my gramophone which I have described in Letters Patent No. 372,786, granted to me on November 8, 1887, and for which I have also received Letters Patent of Great Britain, No. 15,232, dated November 8, 1887. In said patents I have described a method of recording and reproducing sounds, which consists in first causing the sounds to inscribe themselves upon a layer of non-resisting material in a manner substantially like that practiced by the well-known Leon Scott phonautograph, then copying the phonautographic record in solid resisting material, preferably by the photo-engraving process, and then reproducing the sounds from the solid copy of the record. The original record, as well as the copy of the same, is thus obtained as an undulatory line of even depth, as distinguished from a line of varying depth obtained by the ordinary phonograph and by the graphophone.

In my present invention I retain all the fundamental features of my gramophone, but introduce certain novel features both in the process and in the apparatus, which render the attainment of the objects of a sound recorder and reproducer more certain and more perfect.

In the original form of my gramophone I employed a curved (cylindrical) surface upon which the non-resisting medium used for recording was supported. This had the disadvantage that for the purpose of copying the record by the photo-engraving process such surface had to be first straightened and the flat copy obtained from the same had to be bent again to the original cylindrical form of the record-surface. This involved delicate and tedious manipulations, which I avoid in my present invention by inscribing the record of sounds upon a flat plate, and I further improve the process by arranging that flat plate horizontally, or nearly so, and by inscribing the record upon the under surface of the same, whereby the material removed by the recording-stylus drops away from the plate and leaves the undulatory groove of even depth, clean, and well defined, whereas by the old method the material removed by the stylus accumulated in and about the adjacent grooves.

I have further improved the process by using a transparent plate as a support for the non-resisting medium. This plate is therefore made either of glass or some other like substance, whereby I secure several important advantages. The most important of these advantages is that it enables me to work with parallel transmitted rays of light in the subsequent process of photo-engraving, in which the original record is thus used as a negative, which may be directly applied in contact with the sensitive photographic plate, and another important advantage is the reduction of the friction of the stylus upon the supports to a minimum.

The process is further improved by the employment of a new recording medium. In the original process I used a layer of lampblack pure and simple, and this substance is well adapted for the purpose on account of the slight coherence of the particles; but by reason of the flocculent nature of this substance the lines drawn upon it are more or less ragged, as can be observed under a microscope, and the photo-engraving obtained from such record displays all the defects of the original. In my improved process I employ a layer of a semifluid ink or paint, of such consistency and thickness that it will neither subside nor flow spontaneously. Such ink is practically structureless, and the lines drawn upon it are exceedingly sharp and reveal no ragged edges under a powerful microscope, and the photo-engraving from such record is far superior to a like copy from a record produced under the former process.

My invention also comprises other minor improvements in the process, and it also covers novel features in the apparatus, all of which will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, in which I have illustrated convenient forms of apparatus which I have used, without, however, limiting myself to the exact details of the same.

Figure 1 is a perspective view of my improved gramophone. Fig. 2 is a plan view of the diaphragm, with its support and accessories. Fig. 3 is a vertical section showing the recording-disk and its connection with the driving-wheel. Fig. 4 is a sectional view of the diaphragm, its support, and accessories. Fig. 5 is a cross-section on line *x x* of Fig. 2. Fig. 6 is a sectional view of a part of the driving-gear. Fig. 7 is a section showing the connection of the driven shaft with the support of the recording-disk. Fig. 8 is a sectional view of a centering device. Fig. 9 is a plan view, upon a reduced scale, of a disk with a record of sounds recorded upon the same in accordance with my invention. Fig 10 is a sectional elevation of a modified form of my reproducing apparatus, and Fig. 11 is a sectional view of a dampened reproducing-disk.

Referring now to the drawings, in which the details are marked by numerals, there is a platform 1, suitably supported, and upon this platform are mounted the operative parts of the apparatus. A metallic plate 2, provided with a longitudinal rib 3, is secured upon the platform, and standards 4 4', mounted upon plate 2, are provided with a nut-bearing 5 and a smooth bearing 5', (see Fig. 6,) respectively, for shaft 6, which extends through these bearings, as shown. One-half, more or less, of this shaft is screw-threaded, as shown, and enters the nut-bearing 5, and at a point near the middle said shaft passes loosely through a movable support 7, the position of which upon the shaft is determined by two collars 8 8, as indicated in Fig. 7.

The support 7 serves as a bearing for a bevel-gear 9, which is centrally perforated and widens out into a circular flange 10. Upon its under side the bevel-gear 9 is recessed, and said recess fits loosely over the upper end of support 7. A screw 11, passing loosely through the central perforation of bevel-gear 9, screws into the head of support 7, so that the bevel-gear can rotate about its axis, which coincides with the axis of screw 11. Two screw-pins 12 12, which may be either fixed or removable, project at diametrically opposite points from flange 10, and are designed to pass through two similarly-located holes in a glass plate 13, as will be more fully described hereinafter.

A bevel-gear 14, fixed upon shaft 6, engages bevel-gear 9, but provision is made for releasing gear 14 from the shaft, if desired, for a purpose which will be explained farther on. As stated above, the screw-threaded portion of shaft 6 passes through nut-bearing 5, and it will now be clear that if shaft 6 is rotated bevel-gear 9, with its flange 10, will likewise rotate, and will at the same time advance in a straight line, since shaft 6, screwing into or out of its nut-bearing 5, will carry bevel-gear 14 and support 7 with it. From the bottom of support 7 two lugs 15 15, one on each side of rib 3 of plate 2, serve to guide the support with the parts attached thereto in the line of said rib, which is, of course, parallel to shaft 6.

A part of the smooth portion of shaft 6 has a longitudinal groove 16 extending to the right-hand end of the shaft, as seen in Figs. 1 and 6, and a sleeve 17 loosely fitting this portion of the shaft has a pin 18, the end of which engages groove 16, as shown in Fig. 6, so that the shaft is free to slide longitudinally through sleeve 17 and will rotate with the same if the latter is rotated.

Sleeve 17 is fitted into bearing 5' of standard 4', so as to rotate within the same, and upon that part of the sleeve which projects beyond the bearing is keyed the compound gear 19. The latter is composed of a pinion 20 and a bevel-gear 21, and a rather large bevel-wheel 22, mounted upon a shaft 23 below platform 1, meshes with pinion 20.

A small bevel-gear 24 meshes with gear-wheel 21, and to the shaft of gear 24 are secured fans 25, which are thus driven at a high speed and serve as a regulator, as will be readily understood by those skilled in the art.

A weight 26 is suspended by cords or chains 27 from shaft 23, and if said shaft is turned by a crank 28, or otherwise, in one direction the cords or chains are wound upon the same, as indicated in Fig. 1, and the weight 26 is raised up toward the platform. If, on the other hand, the weight is allowed to descend, it will rotate shaft 23, this in turn will rotate gear-wheel 22, which, meshing with pinion 20, will rotate the latter and the connected shaft 6, and in the manner hereinbefore described support 7 will receive a rectilinear motion, while flange 10, upon bevel-gear 9, will both rotate and move in a straight line. For every complete revolution of bevel-gear 14 support 7 and bevel-gear 9, with its connected flange 10, will be moved in the line of a diameter a distance equal to the pitch of the screw-threads upon shaft 6, and it will now be understood that if a plate 13 is fixed to flange 10 and a fixed pencil or stylus be lightly pressed upon the plane surface of said plate a spiral line will be drawn upon the plate.

The recording-stylus 29 is mounted upon a diaphragm 30, and the diaphragm itself, which may be of any suitable sonorous material, is mounted in a case 31, and a rigid tube 32, projecting from one side of the case, communicates with a flexible tube 33 and a mouth or ear piece 34. The tube is clamped and may be adjusted in the direction of its length in a ring 35, formed at the end of a rod 36, which is adjustable in a support 37, and the latter is again adjustable vertically in a standard 38 mounted upon platform 1. A metal post 39 is fixed to the center of the diaphragm, as shown, and its free end has an axial slot 40, into which a soft-rubber tube 41 is forced and flattened. The free end of the soft-rubber tube receives the stylus 29, which may be of metal or any other hard and fairly elastic material.

Preferably the stylus is made of a flat strip of phosphor-bronze extending radially over the face of casing 31 and some distance beyond the edge of the same. At its free end the stylus is reduced to a point and is curved upwardly, and by turning the diaphragm-case about the axis of tube 32, or by turning rod 36 in its bearing 37, or by adjusting the latter upon bracket 38 the point of the stylus may be brought into light contact with the lower face of disk 13 at a point in the diameter of said disk which is parallel with shaft 6.

Near the middle of its length a hole is produced through the stylus, and a pin 42, formed at one end of a metal block 43, passes through said hole and into the central bore in a similar block 44. Between each block and the adjacent face of the stylus a soft-rubber washer 45 is inserted, and the two blocks are forced together and are made to clamp the stylus between the rubber washers by means of the pointed screws 46, working in the supports 47. The screws 46 46 thus constitute the pivotal supports of the stylus, which is a true two-armed lever. A piece of soft-rubber tubing 48 is inserted between the outer arm of this lever and the casing 31, and another piece of soft-rubber tubing 49 is slipped over the stylus between the elastic support 48 and the outer end. Thus it will be seen that the stylus is elastically supported and amply dampened, and that if the diaphragm vibrates under the impact of sound-waves the free end of the stylus will move to the right and to the left of its position of rest and parallel to the face of disk 13.

The disk 13 is preferably made of glass. It is of suitable diameter and thickness, and has two holes 12′ 12′, corresponding to the pins 12 12 projecting from flange 10, and is placed in position upon said flange with the pins entering the holes. The nuts 50 50 are then screwed down, whereby the glass disk is securely clamped.

The method of recording and reproducing recorded sounds by means of this apparatus will now be easily understood.

As has been stated above, the non-resisting material upon which the sound-record or phonautogram is produced is a semifluid, and I can use for this purpose any ink, as, for instance, printers' ink, of the required consistency. An even layer of this ink may be spread over the under surface of the glass disk in any suitable manner, as, for instance, by means of a brush or roller while the disk is slowly turned; but I prefer to produce the ink directly upon the disk itself, and I proceed in the following manner: The under surface of the glass disk is first carefully polished and dried, and is then covered with a thin film of oil by means of a camel's-hair brush. This is done while the disk is rotated with moderate speed. Any oil or fat may be used, but I have found linseed-oil specially adapted for the purpose. A smoky flame is then held under the glass plate while the latter is slowly rotated, whereby the lampblack ascending from the flame is intercepted by the plate and becomes deposited upon the same in a very fine layer, which, however, is instantly absorbed by and mixes intimately with the thin layer of oil, thus forming a black amorphous ink, covering the under surface of the glass disk in an even exceedingly thin layer. It is essential that the lampblack be deposited upon the oiled disk by the described process of sublimation; that is to say, the carbon particles must reach the disk and mix with the oil at the moment when their transition from the gaseous into the solid state takes place. If it were attempted to apply lampblack already formed by dusting upon the oiled disk, no intimate mixture resulting in an even layer of amorphous ink would be obtained. The coating of ink thus directly formed upon the disk has just the consistency and the thickness required. It will not flow spontaneously, and while it adheres well to the glass plate, it requires only a minimum force to remove it from the same, and the point of the stylus in its passage through the substance of the ink experiences no perceptible resistance. The disk is now ready to receive the phonautogram, and it is moved to the position shown in Fig. 1, with the point of the stylus near the outer edge. The point of the stylus is then adjusted into light contact with the disk, so that the coat of ink is barely penetrated by the same, and the weight 26 is allowed to descend and to rotate shaft 6 in the manner hereinbefore described. If now the stylus remained immovable, it would describe upon the under surface of the disk a smooth spiral the convolutions of which continuously decrease toward the center of the disk. The pitch of the spiral is determined by the pitch of the screw upon shaft 6 and by the relative angular velocities of said shaft and of bevel-gear 9, and may in practice be made as small as one-fiftieth of an inch. If now during the progress of the disk sound-waves are directed against the diaphragm through the mouth-piece 34 and tubes 33 and 32, the stylus will vibrate to the right and left of the spiral line, inscribing upon the disk an undulatory line of even depth, which line will truly and accurately represent the sounds uttered against the diaphragm. The stylus removes a very sharp line of ink from the disk, leaving the latter quite transparent at this line, while it is quite opaque and will not transmit light at the places not touched by the stylus. The ink removed by the stylus drops away from the disk, as stated above, and does not accumulate in and about the grooves.

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An approximate idea of the phonautogram thus produced can be obtained by inspection of Fig. 9, which represents an undulatory spiral line upon a disk, with the pitch of the spiral and the undulations of the record greatly exaggerated. In the drawings, the undulatory line appears black upon a white ground, while in fact the line is transparent upon a black ground.

The phonautogram may extend to within a short distance from the edge of flange 10, and in practice the cords or chains 27 27 are made just long enough to drive the disk up to that limit, or the apparatus is mounted at the proper height above the ground so that the weight will be arrested before the limit of progress of the disk is reached. Bevel-gear 14 is then disengaged from bevel-gear 9 by unclamping the same from shaft 6 and sliding it upon the same a short distance to the left hand, (in the view shown in Fig. 1,) and the disk is then given a single rotation by hand, whereby the stylus describes a true circle 51 upon the disk. This circle, which I call the "centering-circle," is afterward utilized, as will presently appear. The glass disk, with the sound-record and centering-circle upon the same, is now removed, and the record may be fixed by applying a thin coat of varnish. It may then be handled with impunity. From this record I produce a copy in copper or any other metal by the process of photo-engraving, and in this process I use the original record as a negative, which enables me to work by transmitted light and with parallel rays, the negative being applied directly in contact with the sensitive photographic plate. The copy thus produced will have the exact size of the original, as is well understood by those skilled in the art. In the photo-engraved copy the sound-record appears as an undulatory line of even depth upon a solid metal disk, and the centering-circle 51 is reproduced in the same manner.

For reproducing the original sounds, the center of the centering-circle is determined by well-known simple geometrical constructions, and a small hole is drilled through that center, which hole corresponds to the mathematical axis about which the glass disk had been rotated, and also marks the axis about which the metal disk must be rotated by the apparatus shown in order that the pointed stylus applied to the starting-point of the record may follow the same from beginning to end. Two holes corresponding to the holes 12' 12' in the glass-disk are also made in the metal disk, but these holes are preferably made large enough to permit the disk to be adjusted in either direction when placed upon flange 10. Before this is done a well-fitting cylindrical block 52 is placed into that part of the cylindrical hole through the common center of flange 10 and bevel-gear 9 which is occupied by the head of screw 11, as shown in Fig. 8. This block, which I call the "centering-block," has a fine axial hole 53, which corresponds exactly to the mathematical axis of rotation of bevel-gear 9. If now the photo-engraved copy of the record is placed upon flange 10, with pins 12 12 passing through corresponding holes in the metal plate, a fine pin, say a sewing-needle, is passed through the centering-holes in the disk and in block 52, and the clamp-nuts 50 are tightly screwed down. By this simple process the metallic copy of the original record is safely and quickly centered in position. The stylus is then adjusted with its point in engagement with the outer end of the record-groove, and the weight 26 is allowed to descend. It will now be clear that the stylus will be forced positively to follow the undulations of the record, and that the diaphragm vibrating under the stylus will emit the same sounds which produced the original record, which sounds can be distinctly heard at the ear-piece 34.

Both the process and the apparatus thus far described may be modified in various ways without departing from the main features of my invention. So, for instance, I can dispense with the centering device and can rotate the record upon a stationary axis, if the diaphragm with its attached stylus is mounted in a manner to make it follow the spiral record. An arrangement of this character is shown in Fig. 10. The reproducing-disk 54 is in this case mounted as hereinbefore described, but without regard to the centering device. The support 7' may be fixed in position so that the bevel-gear 9, mounted upon the same in the manner described with reference to Fig. 3, will turn without progressive motion. Bevel-gear 9, and with it the reproducing-disk 54, are rotated by a bevel-gear 14' upon a shaft 6', to which power is applied by a weight, as shown, or in any other suitable manner. The diaphragm-casing 31 is secured to a small truck 55 upon rails 56 arranged vertically above and parallel with a diameter of the reproducing-disk, and at such height above the same that the stylus 29 will be in engagement with the undulatory grooves of even depth which represent the record of sounds.

The listener applies his ear to the ear-piece, and when the shaft 6' is rotated the stylus and diaphragm will be forced to vibrate, as in the apparatus shown in Fig. 1, but will at the same time move with the truck 55 across the face of disk 54. A tolerably good reproduction may also be obtained by simply holding one end of a reed between the teeth and the other pointed end of the same in engagement with the record-grooves while the disk is rotated.

The frictional contact of the reproducing-stylus with the surface of the ordinary metallic record gives rise to disturbing sounds, and with a view of avoiding the same I mount the reproducing-disk 54 (see Fig. 11) upon a rigid plate 58, and with a sheet 57, of

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felt, soft rubber, blotting-paper, or other non-sonorous substance intervening. This dampens the extraneous vibrations of the reproducing-disk and renders the sounds emitted by the diaphragm very clear.

Additional clearness is obtained by nickel-plating the metallic record, which is ordinarily made of copper, since I have found that the sound due to the frictional contact of the stylus with a polished surface of nickel is very faint.

In place of the metallic copy of the original record I can use a copy made or sealing-wax, which is made from a metallic or other copy having the record in raised lines. The metallic copy is for this purpose first oiled and the molten sealing-wax is then poured over it and is then backed by plaster-of-paris or other rigid material. The cast is then easily removed from the metallic matrix and may be used for the reproduction of the recorded sounds, which will be quite clear and remarkably free of the disturbing sounds due to the friction of the stylus, especially when the surface is first gently rubbed with plumbago.

The metallic copy of the original record is in effect an engraved copper plate, and it may be used as such for printing upon paper, which then yields a copy in raised lines, as is well understood, and from this paper copy the sealing-wax copy or a copy of any other similar material may be made.

I desire to emphasize the fact that my recording and reproducing stylus is a flat elastic strip, which will yield in one direction, but not in the other. For this reason the recording and reproducing surface need not be absolutely plane, and the stylus will still retain contact with the same, while it will be positively moved to follow the undulations of the record in reproducing. The point of the stylus may be made of iridium.

Having now fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The method of producing a phonautogram, which consists in removing an undulatory line of even depth of a deposit of ink from a traveling plate, by and in accordance with sound-vibrations; substantially as described.

2. The method of producing a phonautogram, which consists in removing an undulatory line of even depth of a deposit of amorphous ink from a traveling support, by and in accordance with sound-vibrations; substantially as described.

3. The method of producing a transparent phonautogram, which consists in removing an undulatory line of even depth of a deposit of ink from a traveling plate of glass, by and in accordance with sound-vibrations; substantially as described.

4. The method of producing a transparent phonautogram, which consists in removing an undulatory line of even depth from a deposit of amorphous and opaque material from a traveling support of glass, by and in accordance with sound-vibrations; substantially as described.

5. The method of producing a transparent phonautogram, which consists in removing an undulatory line of even depth extending along a volute, of a deposit of amorphous and opaque material from a rotating disk of glass, by and in accordance with sound-vibrations; substantially as described.

6. The method of producing a layer of semi-fluid ink upon a phonautographic support, which consists in first applying a coat of oil, or other fat, upon the support, and then sublimating upon the oiled surface a thin layer of lampblack; substantially as described.

7. The method of producing a phonautogram, which consists in removing an undulatory line of non-resisting material from the under surface of a traveling plate, by and in accordance with sound-vibrations; substantially as described.

8. In a gramophone, the combination of a sound-receiving sonorous body; with a pivoted stylus controlled by and controlling the same, and a support adapted to carry a phonautogramic recording-surface, or a copy of such record in solid resisting material, traveling in the plane of vibration of the point of the stylus; substantially as described.

9. In a gramophone, the combination of a sonorous diaphragm and a pivoted stylus; with an elastic connection between the diaphragm and stylus, and an elastic reactionary dampening-support for the free arm of the stylus; substantially as described.

10. In a gramophone, the combination of a pivoted stylus, with an elastic connection between the diaphragm and the stylus; substantially as described.

11. In a gramophone, the combination of a vibratory diaphragm and a stylus controlled thereby and controlling the same; with a rubber tube clamped to the diaphragm and connecting the stylus with the latter, and a pivoted support for the stylus between its free end and its connection with the diaphragm; substantially as described.

12. In a gramophone, the combination of a vibratory diaphragm and a stylus elastically connected therewith; with a pivoted support for the stylus located between the free end of the same and its connection with the diaphragm; dampening-washers between the stylus and its pivotal support, and a reactionary dampening-support for the free arm of the stylus; substantially as described.

13. In a gramophone, the combination of a horizontal traveling support for the record-surface; with a vibratory diaphragm, and a recording-stylus bearing upon the under surface of the support; substantially as described.

14. In a gramophone, the combination of a

metallic record of spoken words or other sounds; with a backing of non-resonant material; substantially as described.

15. In a gramophone, the combination of a sound-receiving diaphragm, mounted in a suitable casing; with a tubular sound-conveying stem projecting from the casing, and an adjustable support for the tubular stem; the connection between the casing and tubular stem being such as to permit of the rotation of the casing relative to the stem for adjustment, substantially as described and for the purpose set forth.

16. A device for centering a spirally-extending record, of sounds upon a reproducing apparatus, consisting of a rotatable record-support having a central recess, a block fitting the said recess and having a perforation coincident with the mathematical center of rotation of the record-support, and means for holding the record upon the support, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EMILE BERLINER.

Witnesses:
JACOB G. COHEN,
CHAS. W. HANDY.

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EMILE BERLINER.

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UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY & FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF WERNER SUESS.

CITY OF WASHINGTON, }
District of Columbia, } ss:

Mr. Werner Suess, a citizen of the United States, residing at Washington. D. C., being duly sworn, deposes as follows:

I have been mechanician to the University of Marburg, Germany, for ten years; while there I made acoustical and other philosophical apparatus for the laboratories of the University under the direction of Professors Bunsen, Gerling, Gauss, and Weber; I have been studying the science and the art of acoustics ever since; I acted as mechanician in charge of philosophical apparatus in the United States Coast Survey for eighteen years, during which time I was also assistant to Prof. Joseph Henry in his acoustical experiments in the Smithsonian Institute, and I travelled with Prof. Tyndall in this country in the year 1872, and assisted him in his public lectures on acoustics and other branches of physics. In the year 1887 I became the laboratory assistant of Mr. Emile Berliner, of Washington, D. C., and have worked for and with him ever since.

I am intimately acquainted with the principles of the gramophone and of the graphophone, and I believe

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these instruments to operate on fundamentally different principles.

In the graphophone a record of wax-like material is used in which the operating stylus cuts a groove of varying depth. By reason of the difference in resistance, to the stylus at different depths, this record is somewhat distorted, and does not accurately represent the sound-wave which actuated the stylus.

In the gramophone, the record is primarily formed by pushing aside, in a laterally sinuous line of uniform depth, an exceedingly thin film of fatty and mechanically non-resisting material which covers a zinc plate. The motion of the stylus is just like that of writing with a pencil on a sheet of paper.

In the graphophone the wax record may be and usually is directly used for reproducing. In the gramophone the record is etched into the zinc plate by acids, this zinc plate is then copper-plated, and the copper plate thus obtained is used to impress the record on as many hard rubber disks as it is desired to make.

In the graphophone the stylus is moved perpendicular to the face of the record tablet or cylinder. It is moved upward by the undulating line at the bottom of the record groove. It is moved downward by the elasticity of the diaphragm. In the gramophone the stylus is moved parallel to the face of the record tablet, and the stylus is moved positively in each direction by the side walls of the groove. The bottom of the groove plays no part in the gramophone.

WERNER SUESS.

Subscribed and sworn to before me this 21st day of November, 1898.

[SEAL.] HUGH M. STERLING,
Notary Public.

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JOSEPH LY
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UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY & FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF JOSEPH LYONS.

CITY OF WASHINGTON, }
District of Columbia, } ss:

JOSEPH LYONS, being duly sworn, deposes and says:

(1) I am of lawful age, a citizen of the United States, residing at Washington, in the District of Columbia, and I am a solicitor of patents and a mechanical and electrical expert. I was an Examiner in the United States Patent Office for seven years and I had charge of the examination of applications for patents for improvements in Telephones for five years. While in that position it was my duty to examine patent applications with respect to sufficiency of description and illustration; with respect to operativeness or utility of the inventions set forth in applications, and with respect to the novelty of the alleged inventions.

(2) Telephonic instruments being essentially acoustical apparatus it was my duty to inform myself with respect to developments in the science of acoustics, and I performed that duty to the best of my ability. I read and studied diligently books and periodicals relating to acoustics, and I believe that few developments in that science escaped my notice.

(3) I have always devoted considerable time to the

study of acoustics, and had obtained, from the late Prof. Joseph Henry, of the Smithsonian Institution, and, after his death, from the late Prof. Baird, of the Smithsonian Institution, permission to use and experiment with the acoustical apparatus in possession of that Institute, and I spent many nights, through a period of several years, in the laboratory which was there placed at my disposal.

(4) Since the summer of 1885, when I left the United States Patent Office, I engaged in the business of solicitor of patents and mechanical and electrical expert, and in these capacities I prepared and prosecuted a vast number of applications for patents, and among them a considerable number of patents for inventions in acoustical apparatus, and testified frequently in interference proceedings before the Patent Office, and in infringement suits before the Courts.

(5) I know quite thoroughly the sound recording and reproducing apparatus known as the GRAMOPHONE, invented by Mr. Emile Berliner, and the processes involved in the use of the same. I became acquainted with Mr. Berliner's inventions in this line in the fall of the year 1887, and continued to be informed of all developments, experiments, and improvements which he made in this line of work, until the present time. I was Mr. Berliner's solicitor for procuring all patents that he obtained for his inventions in sound recording and reproducing apparatus.

(6) I am familiar with the Edison Phonograph and with the literature relating thereto, and I am quite familiar with the sound recording and reproducing instrument known as the GRAPHOPHONE, as the same is described in the Letters Patent involved in this motion, and also as the same is represented by the apparatus that is publicly sold under that name. I used the Graphophone experimentally, as soon as it became accessible to the public, and have followed its phases of development up to the present time.

(7) I have read the motion papers in this case and

particularly the affidavits appended thereto, and I have also read the pertinent portions of the record in the suit of the American Graphophone Co. vs. Leeds et al., recently decided by Judge Shipman, and the decision rendered therein, and I believe that I appreciate all that there appears. I have been called upon to make a comparison between the graphophone and the gramophone, and to give my opinion on the question whether the gramophone, and particularly the gramophone reproducer, infringes the patent involved in this motion, and more particularly whether it infringes claims 19, 20, 21, 22 and 23 thereof. After a careful examination I have come to the conclusion that there is no such infringement, however the claims be construed, so long as they are construed in view of the specification; furthermore, that, as these claims were construed by Judge Shipman, they are certainly not infringed, and that finally, the question of alleged infringement which arises in the present motion was in no way hinted at, much less decided by Judge Shipman.

(8) In the history of the art of recording and reproducing sounds, I find that the first step in this direction was made by the well-known scientist Leon Scott, by an apparatus to which was given the name PHONAUTOGRAPH, and which was afterwards variously improved by himself and by the celebrated mechanician Koenig, of Paris, France, and which is described in every text book on general Physics. Although of scientific interest only, I may state that the general idea of making a visible record of sound waves in substantially the manner of Leon Scott had, before Scott, been practiced and described by the French scientist Duhamel, and the appellation Phonautograph was actually first used by him. This scientist caused a fine stylus, fixed to one prong of a tuning fork, to inscribe its vibrations upon the smoked surface of a rotating glass (or metal) cylinder; he thus obtained a sinuous or undulatory line upon the cylindrical surface. Leon Scott substituted for the tuning

fork a vibrating membrane or diaphragm, by which he was enabled to cause the stylus to be acted upon simultaneously by a number of tones directed against the diaphragm.

(9) The next step in the direction of recording, and also of reproducing sounds, was taken by Charles Cros, a French scientist, who on April 30th, 1877, deposited a sealed paper with the Secretary of the French Academy of Science, which was opened and read after Edison's Phonograph had become known, and it was found to contain a description of how to record and reproduce sounds. It was a mere scientific conception and was, so far as the world knows, not followed up by actual work. It however described very clearly the inscription of sounds upon a smoked surface in the fashion of Leon Scott, and how, from this picture, a photo-engraving in metal might be obtained, the metal sound record being then represented by a sinuous or undulatory groove of even depth ; and how, from the same, the recorded sounds might be reproduced

(10) It is necessary to dwell upon the disclosure of Mr. Cros in order to appreciate the direction in which he worked and which, as will appear further on, Mr. Berliner followed. A phonautographic inscription of sound upon a smoked surface is a surface picture ; it has no appreciable depth, and if it had any depth, the same would have no value. It is only in so far as the picture, the sinuous line, is sinuous on the surface upon which it appears, that it is a picture of the sound waves that produced it. It is only by the fact that the eye is obliged to travel from point to point to the right and to the left upon the surface, that the mind receives an idea of the sound waves that produced the picture. Similarly, in the photo-engraving of this picture, the groove produced can be identified with the sound waves, which are the primary cause of it, only by the fact that the eye is obliged to travel upon the metal surface to the right and to the left ; only for this reason the mind may receive an adequate conception of the origi-

nal sound waves. And, similarly, when sound is reproduced by this groove, it is due to the fact, and only to the fact, that motion is given to a diaphragm by the deviations of the groove alternately to the right and to the left. The depth of the groove has nothing to do with the reproduction of the sound; the groove might be bottomless, that is to say, it might be a slot, and the reproduction of sound would not thereby be affected in any way or manner. The Cros record, therefore, is constituted by the laterally undulating walls of the groove. If a stylus connected to a diaphragm be inserted in this groove, and the metal plate containing the groove be moved in the general direction of the groove, this stylus will receive lateral thrusts by the walls of the groove, now on one side and then on the other. This is the mode of reproduction of recorded sounds that was described by Cros on April 30th, 1877.

(11) At very nearly the same time that Cros was engaged in his purely scientific investigation, Mr. Thomas A. Edison was engaged in the construction of his world-famed Phonograph.

(12) Edison cut loose from the ideas of Duhamel, Leon Scott, and Cros, and did not attempt to obtain an inscription of sound waves upon a surface. He had discovered that when loud sounds are uttered against a diaphragm, the vibrations of the latter are apt to yield more mechanical force than was suspected up to that time. In fact he greatly overestimated the force of a vibrating diaphragm, and he is reported of having said, at that time, that a hole might be drilled through a wall by the vibrations of a diaphragm. With this estimation of the force of vibrations of a diaphragm under the influence of sound waves, he conceived the idea of producing a record groove directly by the vibrations of the diaphragm, not indeed by penetrating below the surface and into any material, but by indenting some soft yielding material, and he selected tin foil for this purpose. This tin foil he spread over the surface of a metallic cylinder, which had cut into it a smooth heli-

cal groove, and he caused the cylinder to revolve and also to move axially so as to maintain the stylus of the diaphragm always in light contact with the tin foil, exactly above the groove in the cylinder. If he then vibrated the diaphragm by sound waves, the stylus would indent or fold the tin foil into the groove of the cylinder to varying depth. He thus obtained, as his record, a groove with sloping walls, and with an undulating bottom.

(13) From this record sounds were reproduced by placing the diaphragm parallel to the face of the cylinder, with its stylus fitted into one end of the record groove and perpendicular to the face of the cylinder, the stylus being in contact with the bottom of the same and causing, by suitable movement of the cylinder, the groove to pass under the stylus, whereby the undulatory bottom would lift the stylus, and with it the diaphragm to which it was attached, whenever the stylus came to an elevation of the groove, and allow the elasticity of the diaphragm to carry the stylus back into the depressions of the undulatory bottom of the groove. It will be seen from this that, whereas the Cros record was constituted by the laterally undulatory walls of the record groove, the Edison record was constituted by the vertically undulatory bottom of the record groove.

(14) From this it follows, naturally and necessarily, First, the Cros recording stylus had practically no mechanical work to perform, and certainly performed no mechanical work in the formation of the record groove; whereas Edison's recording stylus performed the mechanical work of shaping the record groove.

Second, Cros's record is constituted by the undulations of the lateral walls of the record groove; whereas Edison's record is constituted by the undulations of the bottom of the groove, and

Third, in the reproduction of sound from Cros's record the stylus and diaphragm are acted upon positively, in both directions of its movements, by the lateral walls of the groove, whereas in the reproduction from the

Edison record the stylus and diaphragm are actuated positively in one direction only, and by the bottom of the groove.

(15) The next step in the development of the art of recording and reproducing sounds consisted on the one hand in putting the impractical devices of Edison into commercially useful shape, by Bell and Tainter, in the Graphophone, and, on the other hand, of materializing the scientific conceptions of Cros, by Berliner, in the Gramophone.

(16) Bell and Tainter followed into the footsteps of Edison, they also utilized the idea of making the diaphragm do the mechanical work of shaping the record groove, and of making it so that the undulations of the bottom of the groove represented the sound record. These inventors, however, greatly improved upon Edison's procedure in that they substituted an engraving process for his indenting process. Instead of indenting such soft yielding material as tin foil, they cut or engraved, by the actual removal of material, the record groove into a substance which, while manageable by a sharp cutting tool, was still strong enough to resist disfigurement by ordinary handling, and they discovered a material eminently adapted for this purpose in a combination of wax and paraffine. In this manner Bell and Tainter produced a sharply defined groove, as distinguished from the ill defined groove of Edison, in that, by the cutting action at any one portion of the groove, they did not crowd upon and distort the walls of the next preceding groove, as is necessarily the case in Edison's indenting process. The consequence of this is that, when in the Bell and Tainter process the grooves are placed close together, as for instance one hundred grooves to the inch, the adjacent side walls of two adjacent grooves coalesce at the top into a common ridge. This is a mathematical necessity, if the groove is wide enough, and this is what I observed to be actually the case in common practice with the graphophone. The mode of repro-

duction from a graphophone record is identical with the mode of reproduction from a phonograph record; in both cases the bottom of the groove effects the reproduction.

(17) I have stated above that I became acquainted with Mr. Berliner's inventions in the art of recording and reproducing sound in the fall of the year 1887, and continued to be informed of all developments, experiments, and improvements which he made in this line of work, until the present time. I here add to this, that I was at all times in close touch with Mr. Berliner and with his inventions and experiments in this line, from the fall of the year 1887 until the present time; that all developments, experiments, and improvements which he made in this line of work were communicated to me immediately after they had been made, or within a few days thereof; that many of his experiments I personally witnessed, and that in some of them I participated or acted as assistant; so that the following statements relative to Mr. Berliner's inventions and experiments are made from a personal knowledge of the same which I acquired at the respective times.

We have now to consider the work of Emile Berliner. Mr. Berliner started with the Duhamel and Leon Scott method of inscribing a picture of the sound waves which agitate the diaphragm, upon a surface coated with an infinitesimally thin layer of lampblack; and he then unwittingly fell into line with Charles Cros. Like Charles Cros, he also resorted to the artifice of photo-engraving in metal the phonautographic record, and he thus obtained a laterally undulatory groove of even depth, from which he reproduced the recorded sounds by a diaphragm and stylus, the latter being acted upon positively in both directions by the side walls of the record groove. Mr. Berliner, to my knowledge, never deviated from this principle; but he soon found that lampblack, being ordinarily a loose, flocculent substance, an aggregation of extremely small, but still quite distinct flakes of carbon, would not give such sharp and well defined tracings as are required for the reproduction of sounds. These tracings, when inspected by the unaided eye, looked fair and sharp enough, but when inspected through the microscope, the edges appeared very irregular, saw-tooth fashion, and he at once understood that, in the process of photo-engraving, all these irregularities were reproduced, so that the record edges of the grooves obtained in metal also received these innumerable saw-tooth irregularities.

(18) About the same time, however, Mr. Berliner observed that, in some cases, the phonautographic tracings were peculiarly smooth and in a large measure free of the saw-tooth irregularities, and he finally discovered that this was the case when the smoky flame, from which the lampblack deposit was obtained, was placed rather close to the cylinder or disk. He accounted for this by the fact that, under these conditions, the lampblack still carried with it a small portion of the unburned oil or fat, which, being deposited together with the lampblack, mixed with the latter and formed with it a kind of printer's ink. He then concluded that if he could form upon the record tablet a film of a more perfect ink than was furnished by the imperfect combustion of oil or fat, he might obtain a sound tracing that would be free of the saw-tooth irregularities. He did this in a variety of ways, and the results obtained were far superior to those which he had obtained from lampblack.

(19) It would lead me too far, and it would serve no useful purpose, if I here attempted to recite in detail the various improvements which now followed, and it is sufficient to say that Mr. Berliner finally substituted for the fatty ink, as a ground for his sound tracings, a fatty film, obtained from a partial solution of bees-wax in benzine; that he deposited this tracing ground directly upon metal, and etched the sound tracings into

the latter, by suitable acids. The tracing ground thus also became an etching ground.

(20) In all these different procedures, the permanent record obtained was a laterally undulatory groove of even depth, in metal.

(21) From these metal records very accurate copies could be made by electro-deposition, but these copies were rather expensive, and their production was, in the nature of things, very slow. Mr. Berliner, therefore, undertook the task of copying the original metal record in other hard, and practically indestructible materials, and he finally succeeded in this task, and he now can and does make thousands of very accurate copies from a single metal record, in hard rubber, and in other like substances.

(22) All I have said, by way of comparison of the sound records of Edison and of Bell & Tainter on the one hand, and of the proposed sound records of Cros on the other hand, must be said when the Phonograph and the Graphophone records are compared with the Berliner Gramophone records. In such comparison Berliner simply takes the place of Cros, with this difference, that whereas Cros, so far as we know, only gave the first rough indications of how sounds might be recorded and reproduced, Berliner actually solved the whole problem, in all its details.

(23) I have shown that the Graphophone record is constituted by the vertically undulating bottom of the groove formed in wax, and that the Cros or the Gramophone record is constituted by the laterally undulating walls of a groove of even depth, in metal, hard rubber and other like indestructible substances; and I may here add that, if in the Graphophone record the side walls were utterly destroyed, the record would still remain perfectly intact, so long as the bottom is not injured; while, if in the Gramophone record the bottom were knocked out, the record would still remain intact, so long as the side walls are not injured.

(24) Turning now more particularly to the method

of reproducing sounds from these two radically different kinds of sound records, we have seen that in the Graphophone, the same as in the Phonograph, the stylus and diaphragm are actuated by the undulations of the bottom of the groove; consequently the stylus is vibrated in lines that are at all times normal, that is to say at right angles to the surface of the record tablet, no matter whether the same is a cylinder or a flat disk. It follows from this, that the stylus must bear down, upon the bottom of the record groove. If the stylus were so supported that it could not bear down upon the bottom of the groove, there could be no reproduction of sound.

(25) In the affidavits filed on behalf of the moving party a good deal is said about a "floating" reproducing device, or stylus. This term "floating," is used by these affiants in a figurative sense only. But supposing the stylus were actually, and not merely figuratively, "floating," i. e. suppose that it were maintained in a buoyant condition in the record groove, which is quite conceivable; it would then be maintained continuously out of contact with the bottom of the groove, and reproduction of sound would become absolutely impossible.

(26) On the other hand, if in the Gramophone the stylus were made to actually *float* in the record groove, it would reproduce sound just as well, and in fact a little better than it does now; for, contact of the stylus with the bottom of the groove has nothing whatever to do with the reproduction of sound in the Gramophone, except that it slightly injures the reproduction; whereas in the Graphophone such contact is an absolute necessity.

(27) Now, since, in the Graphophone the record groove is of varying depth, and since the stylus must at all times bear down, or, in the language of the Bell & Tainter patent, *rub* upon the bottom of the groove, it is evident that the pressure with which the stylus bears upon the bottom, must be *yielding*, since it could

otherwise not ride over the highest elevations of the bottom. In the Gramophone, we have seen, the stylus need never come into contact with the bottom of the groove; but if, as is actually the case, the stylus is in contact with the groove, it need not bear down upon the same with any particular pressure, and certainly not with "yielding pressure," since the groove is of even depth.

(28) In the Graphophone, therefore, pressure, yielding pressure, of the stylus upon the bottom of the groove is an absolute necessity; its absence would prevent the reproduction of every sound. In the Gramophone, pressure of the stylus upon the bottom of the record groove, and particularly yielding pressure is quite useless, and if it is there found, it is there either accidentally or for an entirely different reason, and its suppression could, in no way or manner, impair the reproduction of sound. This is not really a question about which there can be a dispute; it is a mathematical certainty. A simple contemplation of the Gramophone record groove proves the truth of the above proposition to the mind of every Geometrician.

(29) As a matter of fact, both in the Graphophone and in the Gramophone the diaphragm with its stylus is mounted upon an arm that is hinged in such manner that the stylus can come in contact with the bottom of the groove; but whereas in the Graphophone this must be so in order to have any reproduction of sound, in the Gramophone this is only so because the groove has a bottom, and because the stylus cannot be kept floating in such groove, and because the contact of the stylus with the bottom does little harm. If, in the Gramophone, the groove were made deeper, and the stylus formed with a tenon, the bottom of the groove need never be touched, and the stylus, diaphragm and hinged arm would be supported by the ledge formed at the upper end of the tenon resting upon the face of the tablet. The operation of the Gramophone would, by this change, remain absolutely unaffected. All this is

so clear that no experimental proof seems necessary, and I am confident that no person skilled in this art would require experimental proof of this obvious truth.

(30) I have, however, seen experimental demonstrations of the fact that contact of the stylus with the bottom of the groove has nothing to do with the reproduction of sound in the Gramophone. Two experiments were made by Mr. Berliner in my presence, in his laboratory.

(31) The first experiment consisted in securing to the hinged arm which carries the diaphragm and stylus a metal bracket, and passing through the latter a heavy and rather clumsy screw, until the lower end of it touched the broad face of the record tablet. The screw was then so adjusted that, when the stylus was inserted in a groove, it could not reach the bottom of the same, but merely passed, rather loosely, between the walls of the groove. When the record disk was now rotated, the sound came out as powerfully as in the ordinary operation. In this operation there could be no contact between the point of the stylus and the bottom of the record groove, the same as if the groove were bottomless, and the experiment demonstrated beyond question that, in the ordinary operation, the bottom of the groove is nothing but an ordinary support, the same as in the experiment was furnished by the broad face of the tablet, or as might be afforded by a table, or in fact by any other unyielding object.

(32) This experiment seemed so conclusive that the most exacting person should have been satisfied. Mr. Berliner, however, being accustomed to deal with very small dimensions, suggested that, owing to possible wabblings of the bed that supported the disk tablet, the stylus might at odd moments have come into accidental contact with the bottom of the groove, and he, therefore, made a second experiment.

(33) There is, in his laboratory, a Gramophone recorder, an exceedingly heavy metal structure, built with

extreme rigidity and nicety and with the object of avoiding all possible vibrations. This machine rotates a turn table and at the same time propels the same in the line of a diameter. Upon this table an original zinc record was secured, and upon a very heavy, rigid, but adjustable arm, overhanging the table, a reproducer was mounted, and the arm then adjusted until the stylus entered a record groove without touching the bottom of the same; the arm was then securely clamped. When the table with the record tablet thereon was rotated, loud and clear reproduction was obtained.

(34) In this experiment the stylus could not by any possibility have any other than its vibratory movements; it could neither move down, or bear down upon the bottom of the groove, nor come into contact with the same in any way or manner, nor could it have any lateral movement, except that imparted to it by the undulatory record groove.

(35) The two experiments were absolutely convincing, but to my mind they seemed quite superfluous, since the geometrical conditions of the Gramophone are, in my opinion, sufficient to convince every person skilled in the art that the bottom of the record groove has no function in the vibratory movements of the stylus; it is there because grooves always have bottoms.

(36) In the Graphophone, in the process of reproduction, the record cylinder is rotated, and the diaphragm and stylus are propelled, by a system of gearing and a screw, parallel with the axis of the record cylinder. The propelling screw being also the screw by which the recording stylus is propelled, it is evident that if the instrument were made with great nicety the reproducing stylus would always, in all positions of the reproducer on the screw, coincide with the record groove, and if the arm which supports the reproducer were allowed to descend, the reproducing stylus would always fit into a record groove. However, the instrument is not built with such nicety, and thus it happens

that if the reproducing arm could only move in a vertical plane, it might, when descending toward the record cylinder, bring the stylus upon the common ridge between two adjacent record grooves. Under these conditions there could be no reproduction of sound, since the stylus must bear upon the bottom of the groove in order to be vibrated and affect the diaphragm. In order to overcome this difficulty, Messrs. Bell & Tainter provided another hinge for the reproducer, a hinge that would allow it to move laterally.

(37) It is obvious that this lateral movement need only have the extent of one-half the width of a record groove, and since, in commercial practice, there are 100 grooves to the inch, it follows that the extent of lateral movement necessary to insure, in all positions, the engagement of a record groove by the stylus, need never be more than $\frac{1}{200}$ of an inch. But allowing for the fact that records are often used for reproduction upon other machines than those upon which the records were made, and liberally allowing for the accidental disagreements between the screw pitches of the different machines, a lateral play of, say, $\frac{1}{50}$ of an inch would be more than is necessary to insure the engagement of the stylus with the groove.

(38) I found, in a graphophone that was bought in the open market as one of the latest and best types, the reproducer to have a lateral play, on each side, of about $\frac{1}{20}$ of an inch, by actual measurement. This is a lateral play far above the actual requirements of the machine. Having this lateral play, the stylus is expected to always slide down the sloping wall of one groove or the other if it should happen to alight upon the common ridge of two grooves. I have secured a micro-photograph of a transverse section of a portion of a Graphophone record, showing a number of record grooves, enlarged thirty (30) diameters; the record was bought in the open market. The photograph was made by Mr. F. T. Chapman and is hereto attached, and is marked

for identification "Chapman Micro-Photograph, Graphophone Grooves."

(39) A careful inspection of this photograph shows that the slopes of the walls, although exceedingly slight, are nevertheless there; and if two adjacent walls are carefully followed upward, the common ridge of both is reached. An ordinary, pointed stylus could probably never descend this waxy slope and reach the bottom of the groove, and probably with the view of facilitating this descent the commercial Graphopone reproducing stylus is made with a ball-shaped end which would not dig into the waxy surface of the walls of the groove, and would therefore allow the stylus to descend the slope of the same with comparative facility. The fact, however, is that the stylus does not easily ride down the very faintly sloping walls of the grooves, the friction between the stylus and the waxy surface being sufficient, notwithstanding the weight of the diaphragm box, to hold the stylus at almost any point on these sloping walls, at least while the wax cylinder is at rest. The jarring incident to the motion of the cylinder, however, may often carry the stylus to the bottom of the groove. But in order to make this descent more certain, it is the practice with experienced users of the graphopone not to rely upon this alone, but to withdraw the diaphragm head from the record tablet and allow it to snap back into operative position, with the expectation that the shaking incident to this procedure would rattle the stylus into engagement with the bottom of the record groove. This practice can be observed in the public salesrooms were graphophones are on exhibition and for sale. It can there also be observed that this practice must, on occasion, be repeated several times in succession, before the sound issued convinces the user that the stylus has come into engagement. Nor is it uncommon for the salesmen of the graphophone to stamp upon the floor in the vicinity of the instrument, as an aid to rattling the stylus into position.

(40) With such wide and shallow groove, the walls of which have a barely perceptible slope, it is indeed necessary to make special provision to insure the descent of the stylus to the bottom of the groove, and this is, avowedly, the object of the hinge that permits the diaphragm and stylus holder to have the slight lateral movement described in the patent, and which, by actual measurement, I have found to be about $\frac{1}{20}$ of an inch.

(41) In the Gramophone the record grooves have an altogether different aspect; they are well defined, narrow and deep, about half as deep as they are wide, and closely approach a semicircle. In addition to this they are separated from each other by comparatively wide stretches of the perfectly flat surface of the record disk; these spaces are generally wider, and sometimes more than twice as wide as the width of a groove. There is room upon the top of this separating wall for a number of Gramophone reproducing styles; there is no ridge from which the point of a stylus will tend to ride down the sloping walls of either one of two adjacent grooves. I have procured a micro-photograph of a transverse section of a portion of a Gramophone record tablet, showing a number of successive record grooves enlarged thirty (30) diameters. This photograph was also made by Mr. F. T. Chapman, and is hereto annexed and marked "Chapman's Microphotograph, Gramophone Grooves."

(42) It will be seen at a glance at the picture, that with such a record it is useless to provide freedom of lateral motion for the stylus for the purpose of allowing the same to slide down to the bottom of a groove, since, if the stylus should happen to alight upon the top of a separating wall, it would safely rest upon the same, and remain there until forcibly transferred to a groove; it would find no sloping wall. For the walls of a Gramophone record groove cannot be said to be *sloping;* they are too steep to deserve this appellation. Moreover, a Gramophone stylus would not ride down

a slope of a Gramophone groove in order to reach the bottom: it would drop into it as into a pit. It follows from this that, if we find in the Gramophone that the diaphragm and stylus holder is so hinged as to be free to move laterally, this must be for an entirely different purpose, because it cannot have the function which this construction has in the Graphophone, and because this function would be quite useless in the Gramophone, where the engagement of the bottom of the groove plays no part in the reproduction of sound.

(43) As a matter of fact, the arm which carries the diaphragm box with its stylus in the Gramophone, *is* hinged to have freedom to move horizontally,—not within the space of $\frac{1}{20}$ of an inch as in the Phonograph, but all over and beyond the face of the record disk, indeed all around a complete circle. And the function of this free, horizontal movement is a most important one; it serves the same purpose, only far more completely, as is served in the Graphophone by the system of gearing, a fine feed screw, and a nut; it serves the purpose of carrying the diaphragm and stylus across the whole face of the record, quite independent of the number of grooves to the inch. The construction was devised for this purpose, and for no other, and Mr. Berliner obtained a most valuable patent for the principle thereof, namely—United States patent No. 534,-543, dated February 19, 1895, a copy of which is hereto annexed, and which contains the following claim:

> "5. The method of reproducing sounds from a record of the same which consists in vibrating a stylus and propelling the same along the record by and in accordance with said record."

The spiral record groove, engaging with its walls the stylus which is carried upon the freely swinging arm, propels the stylus and the diaphragm bodily across the record surface from one convolution of the record groove to the other, from beginning to end. The

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whole system of gearing, with delicate screw and nut, absolutely necessary in the construction shown in the Bell & Tainter patent, which is here under review, becomes unnecessary by the use of this freely swinging arm.

(44) The lateral play of $\frac{1}{20}$ of an inch, which is given to the stylus in the Graphophone would be quite useless in the Gramophone; and a wider lateral play than $\frac{1}{20}$ of an inch, if given to the reproducer arm in the commercial Graphophone, would also be quite useless. In fact, not one half of $\frac{1}{20}$ inch is ever utilized in the Graphophone.

(45) I shall now consider claims 19, 20, 21, 22 and 23 of the Bell & Tainter patent. These claims read as follows:

> "19. The combination, with a reproducing style, of a mounting therefor, which leaves said style-face to move laterally, and thereby adjust itself automatically to a sound-record, substantially as described.
>
> 20. The reproducer loosely mounted on a suitable support, so that the reproducing style is capable of a lateral movement, and may in consequence thereof adjust itself automatically on the record, substantially as described.
>
> 21. The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described.
>
> 22. The combination, with a grooved tablet or other body having a sound-record formed therein, of a reproducer having a rubbing-style loosely mounted, so that it is free to move laterally, and thus adjust itself to the groove, substantially as described.
>
> 23. The combination, with the tablet or other body having the sound record formed therein as an irregular groove with sloping walls, of a reproducer having a style for rubbing over said record and mounted on a universal joint, substantially as described."

These claims, according to my understanding, call for a reproducing stylus mounted in such fashion as to permit it to move laterally, for a certain definite purpose; the purpose is prescribed as being to

> "adjust itself automatically to
> "a sound record;"

and this must be done "substantially as described." Evidently, the mounting of a stylus or of any other object, in such fashion as to be free to move laterally for any or all purposes is not patentable; but when the mounting which gives or allows lateral motion is calculated to produce a new and useful effect, then, of course, it may be patentable.

(46) The function of the lateral movement, in a Graphophone, we have seen to be, to allow the end face of the stylus to ride down the sloping wall of a record groove and to come into contact with the bottom of the groove, that is to say with the "record," to be vibrated by the elevations and depressions of this bottom record. This is the useful purpose of the lateral movement, and for this purpose the construction that allows the lateral movement has been patented, and this, according to my understanding, is the scope of these claims.

(47) To this conclusion I am forced by the reading of the patent, and by a close study of the commercial Graphophone, and I find that Judge Shipman had precisely the same appreciation of the scope of these claims; for in his decision, upon which the moving party must rely, I find the following language.

> "The two improvements of importance with respect to claims 19 to 24 inclusive, are the new material for a sound-record upon which vertically undulating grooves with sloping walls were engraved by a cutting style, and the reproducer which rested upon these grooves by gravity and moving along them, imparted to a second diaphragm the vibrations incident to the elevations and depressions of the bottoms of the grooves."

Consequently, according to my understanding of this decision, the claims in question have their scope limited by the requirement that the stylus rest by gravity upon the record grooves in such manner as to impart to an attached diaphragm "the vibrations incident to the elevations and depressions of the bottom of the grooves."

(48) In the same decision, Judge Shipman says:

> "I think it may be that the improvement in the reproducing style was more than the mounting of an old style upon a universal joint and that the reproducer may be patentable itself, because the style needed not only the lateral motion produced by the universal joint, but also an elastic and yielding pressure against the record, but, if the reproducer is not patentable by itself, I fully agree with Judge Grosscup's idea of the patentable character of the combination, which appears in these claims, and concur with him that any device which combines the reproducer described in claims 19 to 24, with the grooved tablet, or other body having a sound record as described in the patent and especially in claims 22 and 24, is an infringement of the patent in suit."

(49) I understand this to mean that, in so far as the improvement in the reproducing style was more than the mounting of an old style upon a universal joint, namely, in so far as it introduced the function of both lateral motion and elastic and yielding pressure against the record, it "*may be*" patentable by itself. This does not say that it *is* patenable by itself, but that, considering its functions of lateral motion and elastic and yielding pressure against the record, it *may perhaps* be patentable by itself. In the case before him, Judge Shipman was not obliged to decide this question, and he did not decide it. But even if he had decided it, it would make the reproducing stylus mounted upon a universal joint patenable only when it bears *upon the record* with *elastic* or *yielding pressure*, and when it adjusts itself laterally within a groove.

(50) A machine in which the style does not bear

upon the record, and in which there is no *elastic and yielding pressure* would, even under such construction of Judge Shipman's decision, not infringe either of claims 19 to 23 inclusive.

(51) Now, I believe to have shown that the Berliner Gramophone is such machine; that in the same the *record* is not on the bottom of the groove upon which the stylus bears, and that, no pressure, and certainly no elastic and yielding pressure comes into requisition in this machine, since the groove is, all throughout its whole length, of even depth. There being no "elevations and depressions of the bottoms of the grooves," the stylus cannot impart to an attached diaphragm vibrations "incident thereto," as, in accordance with Judge Shipman's decision, must be the case in a machine that infringes any or all of claims 19 to 23 of the patent.

(52) I have examined Edison's English patent, A. D. 1878, No. 1644, and more especially Figures 1 and 2 thereof, and the description relating thereto, and I find it discloses a phonogram tablet or blank having a sound record groove in the form of a spiral line with undulations indented into the bottom of the groove. I also find that the diaphragm and stylus for reproducing the sound is carried by an arm, *i*, which is mounted on a vertical post, 6, so that the arm carrying the diaphragm and stylus can swing horizontally and laterally upon the post 6, as an axis. The range of movement is sufficient to carry the stylus from the first convolution of the spiral sound record to the last convolution of this record; that is to say, entirely across the record. This motion is effected by a separate, inner spiral groove, 3, which is a plain spiral groove, having no sound record therein, and having a pitch equal to the outer spiral groove, 4, in the bottom of which the sound record is found. A pin, *g*, is rigidly fastened to an extension from the arm, *i*, which pin engages the inner spiral, 3, and thus propels the arm, *i*, carrying the stylus, *c*, completely across the record.

(53) Now, although these two figures of drawing of the Edison English patent were apparently not pointed out to Judge Shipman in the Leeds case, it is yet possible that the claims of the Bell & Tainter patent here involved, and as construed by Judge Shipman, may be patentable over the construction shown in these two figures of drawing in the Edison patent, because these figures and the description relating thereto, disclose no wax cylinder with sound grooves having sloping walls, and furthermore, because it may be, though this is improbable, that the mounting for the stylus, *c*, on the spring arm, c^2, in the Edison structure might not give sufficient lateral play to adjust the stylus automatically within the limits of a single record groove. But however this may be, I am bound to consider that this patent of Edison, in these two figures, shows an arm co-operating with the record grooves in the form of a spiral, the arm being pivoted at a considerable distance from the record, so as to make it a long arm and carrying the stylus entirely across all the convolutions of the record, just as in the case of the Berliner gramophone. So far, then, as the lateral movement of the stylus arm of the gramophone is concerned, it is unquestionably found in Edison, and cannot, therefore, be claimed by Bell & Tainter.

(54) From all these considerations I am forced to the conclusion that Berliner's Gramophone does by its construction and operation not infringe any of the claims, and certainly not claims 19, 20, 21, 22 and 23 of the Bell and Tainter patent No. 341,214.

(55) There are other considerations, to which I have hereinbefore briefly referred, that prove to my mind conclusively that the Gramophone in its construction and mode of operation does not infringe any of the claims 19 to 23 inclusive, of the Bell and Tainter patent. The considerations are these:

(56) If the Bell and Tainter mounting of the diaphragm and stylus carrier were put upon the Gramophone, it would be there absolutely useless. The

Gramophone requires for its legitimate functions, one of which is to propel the stylus from one end of the record to the other by the record groove, that the arm to which the diaphragm and stylus are secured, be very long, and that the lateral movement of this arm be sufficient to carry it across the whole record. On the other hand, if to the style-carrier in the Graphophone were given the wide free movement which it has in the Gramophone, it would also be quite useless. Again the diaphragm and stylus of the Graphophone could not be used for the reproduction of sound upon the Gramophone, no matter how the same may be mounted; and the diaphragm and stylus of the Gramophone could not be used on the Graphophone, no matter how the same may be mounted. And, finally, a Gramophone record could not be used on a Graphophone reproducing machine, and a Graphophone record could not be used on the Gramophone reproducing machine.

(57) In other words, none of the essential parts of either machine could be used on the other, without very material change or adaptation; and the change and adaptation would have to be so extensive as to amount to a complete reorganization.

(58) If then I find, as I do, two machines so essentially different that none of the essential parts of one could be used on the other, I am forced to conclude, upon general principles, that in their construction and mode of operation these two machines have nothing in common, except such features as are common to all talking machines, the Edison Phonograph included, namely, a rotating tablet-holder, a motor for rotating it, a reproducing diaphragm and stylus, and a sound conveying tube.

(59) In the affidavit of Andrew Devine, filed with and in support of the motion for preliminary injunction by the complainants in this case, I find the following statement:

> "In the details of its construction the reproducer-support of the Gramophone is practically

> identical with the defendants' device (known as the 'Metaphone' or 'Ecophone') in American Graphophone Company vs. Leeds and Baldwin, in which a final decree was entered in this Court in August, 1898. In both these devices the reproducer is carried on the end of a long pivoted arm, resting by gravity on the tablet, and capable of swinging on its pivot across the entire face of the tablet, the groove in the latter effecting the feed of the reproducer."

It is evident from this quotation that Mr. Devine entertains the notion that, because the Metaphone is in some respects like the Gramophone, and because the Court has held the Metaphone to be an infringement of the Graphophone, the Gramophone must also be an infringement of the Graphophone.

(60) In my opinion Mr. Devine is mistaken, since the Metaphone was not held to be an infringement of the Graphophone, because in the former—

> "the reproducer is carried on the end of a long pivoted arm, resting by gravity on the tablet, and capable of swinging on its pivot across the entire face of the tablet, the grooves in the latter effecting the field of the reproducer."

(61) These features are not at all found in the Graphophone, and can, therefore, not infringe the latter. Nor did the Court hold that it infringes the Graphophone on account of these features, but it held that it infringes because it uses, in addition to these features and in combination therewith, a Graphophone record cylinder, whereon the record is represented by the undulatory bottoms of the record grooves, and in consequence thereof the stylus bears with elastic and yielding pressure upon the record, i. e., upon the bottom of the groove, and whereby it

> "imparted to a second diaphragm the vibrations incident to the elevations and depressions of the bottoms of the grooves."

This feature is not found in the Gramophone and, therefore, though the Metaphone infringes the Graphophone, the Gramophone does not.

(62) The Metaphone, in so far as it has the features which Mr. Devine says that it has, and which it undoubtedly has, infringes not the Graphophone but the Gramophone. The Metaphone is a hybrid machine, a cross between the Graphophone and Gramophone, infringing both, but more glaringly the Gramophone than the Graphophone.

(63) In the affidavit of S. T. Cameron, filed in support of the motion for preliminary injunction by the complainants in this case, I find that Mr. Cameron, in speaking of the Gramophone, says as follows:

> "I find in said machine 'the reproducing-style or rather the "head" of the reproducing instrument' is mounted on what is practically a universal joint so that the style can 'be readily guided by the record;' and that the 'style is pressed against the record by the yielding pressure of a * * weight,' i. e., its own weight and that of its supporting arm."

This statement I find to be essentially incorrect and calculated to mislead. It conveys the idea, and is evidently intended to convey the idea that, in the Gramophone, the stylus is pressed against the *record* by the yielding pressure of a weight, while in fact at the point where the stylus rests with pressure there is no *record* at all. It rests, as I have abundantly shown, upon the bottom of the record groove; but I have also shown that the bottom of the record groove, in the Gramophone, is not the *record*, but is an indifferent and inoperative portion of the groove, which has nothing to do with the reproduction of sound.

(64) In the same affidavit, on page 7, and in other places, I find Mr. Cameron says, that in the Gramophone the stylus is free to move laterally,

> "and thereby adjust itself automatically to a sound record,"

and, that it is free to

> "adjust itself automatically on the record,"

and that it is

> "held against the record by yielding pressure,"

and that it

> "rests on the record by yielding pressure."

(65) These statements, in my opinion, are quite wrong and calculated to mislead, since in the Gramophone the stylus does not rest on the record at all; either by yielding pressure, or by any other pressure.

JOSEPH LYONS.

Sworn to and subscribed before me this twenty-fifth day of November, 1898.

[SEAL.] W. CLARENCE DUVALL,
Notary Public.

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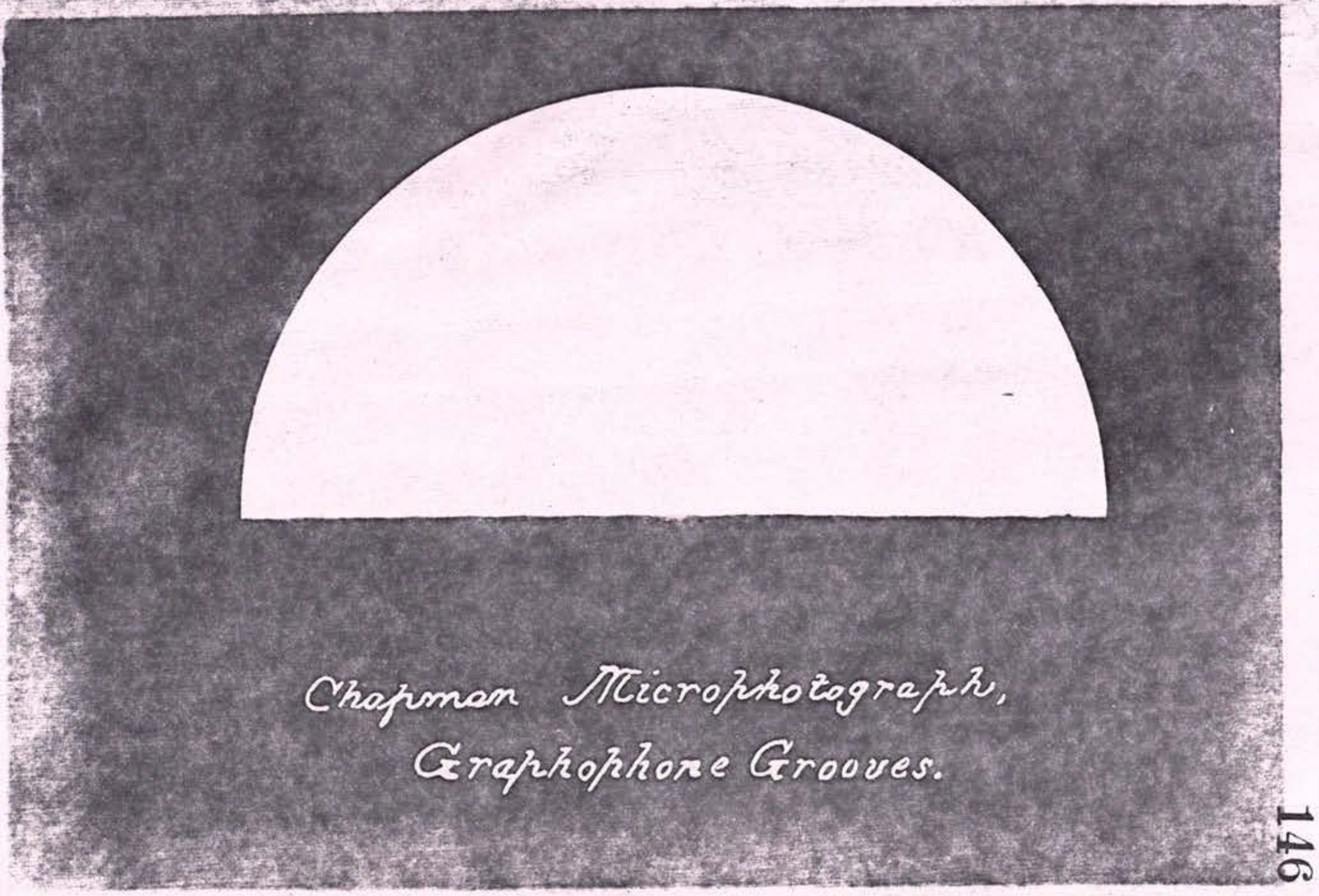
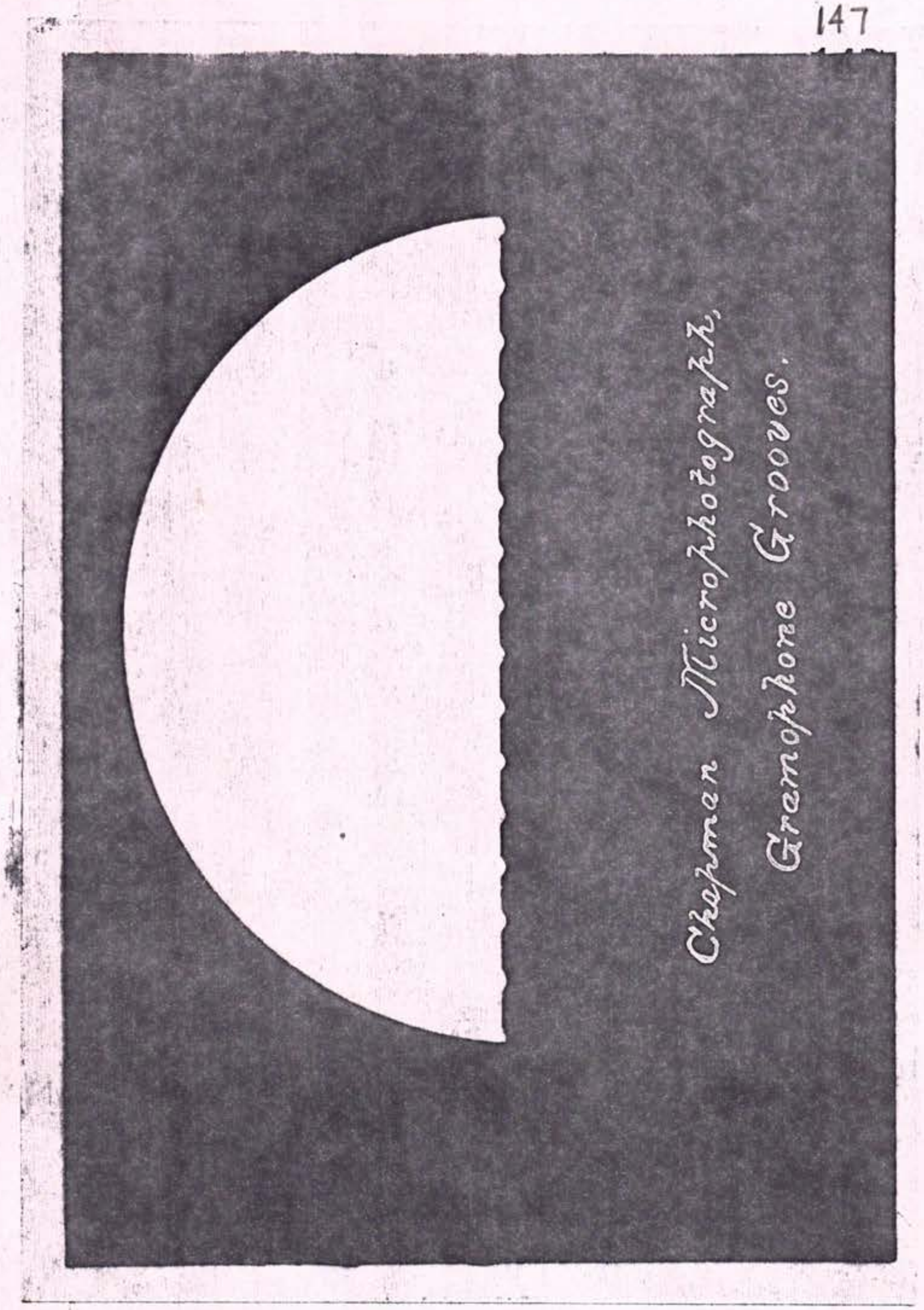


Chapman Microphotograph,
Graphophone Grooves.



Chapman Microphotograph,
Gramophone Grooves.

UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY & FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF JOHN C. PENNIE.

DISTRICT OF COLUMBIA, }
County of Washington, } ss:

Before me, the undersigned, a notary public in and for the District and County aforesaid, personally appeared John C. Pennie, who, being first duly sworn, deposes and says:

I am of lawful age and a resident of the city of Washington, in the District and County aforesaid. I have had a general scientific and technological education in this country and in Europe, and have taken the degree of civil engineer. During the years 1881, 1882, and 1883, I was a member of the examining corps of the United States Patent Office. The duties of my position required me to examine into and pass upon the form and merits of applications for Letters Patent on mechanical structures, to determine the scope of claims made therein, and to make searches among prior patents and publications for the purpose of ascertaining and determining the novelty and patentability of the inventions claimed in such applications, in view of the prior state of the art. In the latter part of the year 1883, I resigned from the Patent Office and continuously since that date have practiced as an attorney-at-law and solicitor of patents; preparing and prosecuting applications for Letters Patent, making investigations and reports as to the scope and validity of Letters Patent, and upon questions of infringement connected therewith, testifying in patent causes as an expert, and in general carrying on such other business connected with Letters Patent and the mechanical arts as ordinarily falls within the duties of my profession.

I have carefully read the specification, in connection with the drawings, of the United States patent to Bell and Tainter, No. 341,214 dated May 4, 1886, in suit herein and believe that I fully understand the construction and mode of operation of the mechanism therein described. I am also familiar with the construction of the Berliner gramophone, as described, for instance in the Berliner patent No. 372,786 dated November 8, 1887, and in the Berliner patent No. 534.543 dated February 19, 1895, and as now commonly sold upon the market, which construction, I understand, is alleged in the bill of complaint herein to constitute an infringement upon the Bell and Tainter patent above referred to.

The graphophone of Bell and Tainter described in the patent No. 341,214, is a meritorious improvement on the old Edison phonograph, which used a record of tin foil having the sound record indented thereon and differs therefrom in using a record of wax or wax-like material into which the record is cut or engraved vertically by removing chips or shavings therefrom in accordance with the vibrations of a recording stylus, moving perpendicular to the surface of the record material. The wax has the advantage that it is soft enough to receive the record without undue distortion by reason of the resistance of the wax and is yet hard enough to withstand a certain amount of wear.

In the graphophone, the sound record is at the bottom of a very shallow and rather wide groove. In order to automatically guide the reproducing stylus onto the record at the bottom of this groove, the graphophone reproducer has a flexible mounting, shown in the patent as a short piece of rubber tubing (32). The extent of the flexibility of this tubing or joint in a *lateral* direction is such as to allow the reproducing stylus to adjust itself, within the width of a single groove, to the bottom of the groove, or at most, in case the stylus finds itself on the top of the ridge between two adjacent grooves, to automatically fall into one or the other of these two adjacent grooves. This clearly appears from page 4, line 65, of the Bell and Tainter patent as follows:

> "No special care is necessary to insure its adjustment, for if the reproducer K be allowed to rest against the record with the style upon the engraved line, the style will of itself gravitate to the bottom of the groove."

The same appears from Mr. Charles S. Tainter's answer to question 7 of his direct examination in the case of the American Graphophone Co., vs. Leeds and others on pages 190–191 of the record and in his answer to x-Q. 24, 25, 26 and 27 on pages 198 and 199 of the record which I have carefully read and I fully agree with Mr. Tainter's views in this regard.

The purpose of the flexibility of the joint in a *vertical* direction in the Bell and Tainter graphophone was to permit the stylus to gravitate to the bottom of the groove and to reach the record there situated.

After a careful study of the decision of Judge Shipman in the Leeds case, it is my opinion that this decision intended to hold as the patentable invention in the Bell and Tainter patent No. 341,214, first, the wax record as above described and, second, the combination of this record with a mounting which would be flexible laterally so as to permit the stylus to adjust itself within the record groove or at most to automatically select one of two adjacent record grooves, and which was flexible vertically so that the stylus could sink down into and find the bottom of the groove, which is necessary to make the machine operative.

I am of the opinion that the Berliner gramophone as described, for instance, in his patents Nos. 372,786 and 534,543 as now commonly sold upon the market does not contain the invention of the Bell and Tainter patent No. 341,214 or of claims 19-24 thereof as they were construed by Judge Shipman.

My reason for this opinion is that the sound record tablet in the gramophone is not of wax but of hard rubber and that the sound record is not found in the bottom of the record groove but on the side walls thereof. This brings about a radical difference in the principle of operation, the gramophone being a development of the well known work of the Frenchman Cros, just as Bell and Tainter's gramophone is a development of the work of Edison.

In the graphophone, the reproducing stylus is moved perpendicular to and away from the tablet face by the bottom of the record groove and is moved perpendicular to and toward the tablet face by gravity or the presence of the spring. In the gramophone however, the reproducing stylus is moved laterally and positively in both directions by the side walls of the record groove.

The gramophone reproducer uses a universal mounting for the sound box carrying a stylus, but instead of having a flexible range laterally of a single groove or at most two adjacent grooves, it has a range taking in the entire series of grooves constituting the record. In fact the purpose of this lateral movement is to dispense with all screws and gears for carrying the stylus and to let the record itself do the work. This valuable feature is, I understand the invention of Mr. Berliner. There is no function in any lateral adjustment within a single groove of the gramophone record because it is immaterial how far the stylus goes down into the groove, the work being done by the side edges of the upper face of the groove. There is also in the gramophone no idea of automatically letting the stylus fall into one of two adjacent grooves since the space between adjacent grooves is several times as wide as the width of a single groove and is entirely flat. The lateral adjustment of the flexible mounting in the phonograph of Bell and Tainter has therefore one purpose and in the gramophone of Berliner an entirely different purpose.

So the flexibility in a vertical direction of the flexible or universal joint of Bell and Tainter's patent is merely sufficient to permit the stylus to get to the bottom of the groove.

In the Berliner gramophone, the vertical movement has no such purpose, for the top edge of the groove does the work of moving the stylus for reproducing speech and the bottom of the groove plays no part in reproducing speech. The purpose of the vertical movement of the mounting of the stylus in the gramophone in fact is to permit the stylus to be lifted up by the hand and to be set down into any particular groove.

Another point to be considered is that in the gramophone, the stylus does not rest by gravity or spring pressure against the record. The point of the stylus rests against the bottom of the groove which is a smooth, straight line where no undulation or sound record is found. Even if there were such an undulation at the bottom of the gramophone groove, it would not assist in producing sounds, since the diaphragm in the gramophone is in a plane perpendicular to the plane of the record tablet and an up and down movement of the stylus would only move the diaphragm in the direction of its plane and not perpendicular thereto as is required to make the diaphragm vibrate. But as the point of the stylus rests against the bottom of the groove and the stylus is tapered to loosely or easily fit the groove, it will be seen that the sides of the stylus bear with no pressure against the side walls of the groove where the sound record is found. The side walls of the gramophone record groove therefore actuate the side of the stylus with only such pressure as is caused by the movement itself and with no pressure caused by gravity. The more perfectly this condition is brought about, the less will sound reproduction be interfered with.

JOHN C. PENNIE.

Sworn to and subscribed before me this 19th day of November, 1898.

[SEAL.] EDWIN S. CLARKSON,
Notary Public, D. C.

UNITED STATES CIRCUIT COURT

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY & FRANK SEAMAN.
} In Equity.

AFFIDAVIT OF FRANK T. CHAPMAN.

CITY OF WASHINGTON, } ss:
District of Columbia, }

FRANK T. CHAPMAN, being duly sworn, deposes and says:

I am of lawful age, a citizen of the United States, and reside at Washington in the District of Columbia.

I have for many years interested myself in microscopical work, and I am familiar with the use of microscopes of modern and most improved construction, and I own a modern microscope, with all auxiliary appliances thereto, and am expert in the use of these instrumentalities. I am a member of the Microscopical Society of Washington, D. C., and have frequently exhibited, before the said Society, microscopical objects of particular interest, which I had prepared. I have contributed to some extent to the current literature of microscopy.

I have practiced photography for the purpose of microscopical investigation and for other purposes, and have attained considerable efficiency in this art.

I have read the pertinent portions of the affidavit of Mr. Lyons, filed in this case, and I there saw two photographic prints marked for identification "Chapman Microphotograph, Graphophone Grooves." and

"Chapman Microphotograph, Gramophone Grooves," respectively, and I recognize in the same prints made from negatives that I had taken from transverse sections of a portion of a Graphophone cylinder which I bought in the open market in this city, and of a transverse section of a portion of an ordinary Gramophone record. By "transverse" I mean in a direction not along the grooves, but at right angles to the grooves. I found the Graphophone record to have 100 grooves to the inch, and the Gramophone record to have 96 grooves to the inch.

As regards the negatives, I say that I have taken them with the utmost care and with the intent that they shall represent a truthful and accurate picture of the objects exposed to them, each magnified to the same extent, namely—thirty (30) diameters, and that I believe that I have succeeded in my efforts. Both negatives I have taken under the same conditions of light.

As regards the prints taken from these negatives, and annexed to Mr. Lyons's affidavit, I find the same true and accurate prints, and to convey to the beholder a truthful and accurate impression of the Graphophone and the Gramophone record grooves, which I had exposed to the negatives, and as the same appeared to me under the microscope.

I FURTHER SAY: that the configuration of the Gramophone record grooves shown in the photograph above referred to, is typical of all Gramophone record grooves that I have examined with the microscope, and that I have examined many of them.

Frank T. Chapman.

Sworn to and subscribed before me this 25th day of November, 1898.

[SEAL.]

Hugh M. Sterling,
Notary Public.

UNITED STATES CIRCUIT COURT

For the Southern District of New York.

American Graphophone Company vs. National Gramophone Company & Frank Seaman.	In Equity.

AFFIDAVIT OF WILLIAM G. HENDERSON.

City of Washington,
District of Columbia, } ss:

WILLIAM G. HENDERSON, being duly sworn, deposes and says:

I am of lawful age, a citizen of the United States, residing at Washington, in the District of Columbia, and am a lawyer, making a specialty of patent law.

I was employed in the United States Patent Office from 1868 to 1874, and during the latter part of that period was in the examining corps, where my duties were to examine applications for patents for inventions in numerous branches of industrial arts and to pass upon questions of sufficiency of disclosure, utility and novelty of alleged inventions.

I was admitted to practice before the bar of the Supreme Court of the District of Columbia in 1874, whereupon I resigned my position in the Patent Office and commenced the practice of my profession, making a specialty of patent law. Since then I have been continuously engaged in the practice of that specialty; I have prepared and prosecuted a large number of applications for patents; have given numerous opinions on infringement and non-infringement of patents; have conducted patent causes in various United States Circuit Courts, and also in the United States Supreme Court, as counsel, and have also testified as an expert in patent causes.

I am familiar with the constructions and principles and modes of operation of the sound recording and reproducing machines known under the names of "Graphophone," "Gramophone" and "Metaphone," and I believe that I have an adequate understanding of their differences and similarities.

I have read Judge Shipman's decision rendered in the suit of the American Graphophone Company vs. Leeds et al. and have also read the motion for preliminary injunction filed herein and pertinent portions of the affidavits filed in support of the said motion, and I believe that I understand what there appears.

From the decision of Judge Shipman, it appears that an infringement of claims 19, 20, 21, 22, 23 and 24, of the patent of Bell & Tainter, No. 341,214, dated May 4, 1886, was found in the Metaphone, because in that machine there is used for reproduction of recorded sounds, a wax record cylinder, having engraved into its surface a groove with sloping walls and of varying depth, wherein the variations of depth represent the sound record, and because such record cylinder is used in combination with a stylus resting by elastic and yielding pressure upon the bottom of the groove and having freedom of lateral and vertical motion to adjust itself automatically to the record, i. e. within a groove, to the bottom of the groove. This understanding of the meaning of the decision of Judge Shipman I receive from a careful reading of the said decision, and in my opinion nothing but what I have above set forth is decided by Judge Shipman to be the patentable invention, and the case before him called for no broader decision.

Upon careful examination of the Gramophone, I find that it contains none of the elements called for by Judge Shipman's decision in order to come within that decision. I find that in the Gramophone there is no engraved wax cylinder; that the record grooves of the Gramophone are not of varying or undulatory depth, but are, on the contrary, of even depth and are sinuous laterally instead of vertically, and that in consequence thereof the sound record is constituted by the side walls of the record groove and not by the bottom thereof.

With such construction of the Gramophone it is impossible that its record shall, as demanded by the decision of Judge Shipman, impart

> "to a second diaphragm the vibrations incident to the elevations and depressions of the bottoms of the groove,"

which is a characteristic of the Gramophone and also a characteristic of the Metaphone. According to my understanding, Judge Shipman's decision was mainly based upon the similarity between the Graphophone and Metaphone; and since nothing of this kind is found in the Gramophone, I believe that the decision cannot be made to apply to the same.

By reason of the record, constituted by the undulatory bottom of the grooves with sloping walls, found in the metaphone as well as in the graphophone, the universal joint of its style carrier has the peculiar function of permitting the style to automatically adjust itself to the record, i. e. to the vertically undulating bottom of the grooves, so as to reach this bottom by sliding down the sloping walls of the groove, and to bear upon the bottom with elastic and yielding pressure. Such function is not found in the gramophone, because of the peculiar and entirely different shape and operation of its grooves, and in its absence the decision of Judge Shipman cannot, as I understand it, apply to the same.

In the Gramophone the universal mounting of the style carrier has a totally different function; it has there the function to permit the stylus to be propelled by the walls of the record groove all across the record tablet, from one end of the record groove to the other and irrespective of the pitch of the spiral line along which the groove extends. In this manner all gears and screws are dispensed with in the gramophone. In so far as the Metaphone also dispenses with gears and screws by the use of a long arm with universal joint it infringes the Gramophone and not the Graphophone; and I find nothing in Judge Shipman's decision that is in conflict with this view.

Wm. G. Henderson.

Sworn to and subscribed before me this 25th day of November, 1898.

[Seal.] John R. Farnum,
Notary Public, D. C.

T. A. EDISON.
Phonograph or Speaking Machine.

No. 200,521 Patented Feb. 19, 1878.

Fig. 1

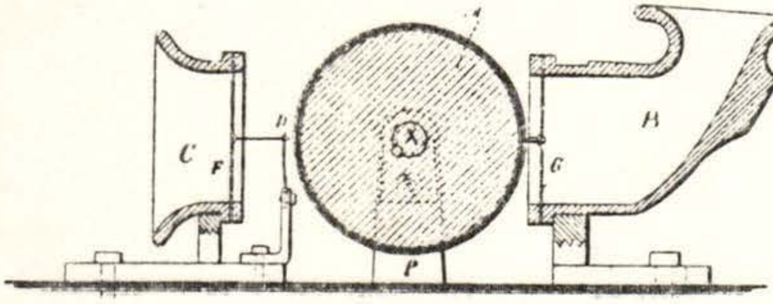


Fig. 4.

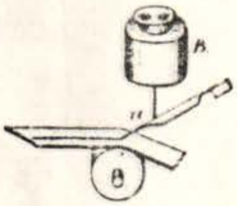
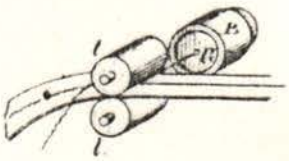


Fig. 3.



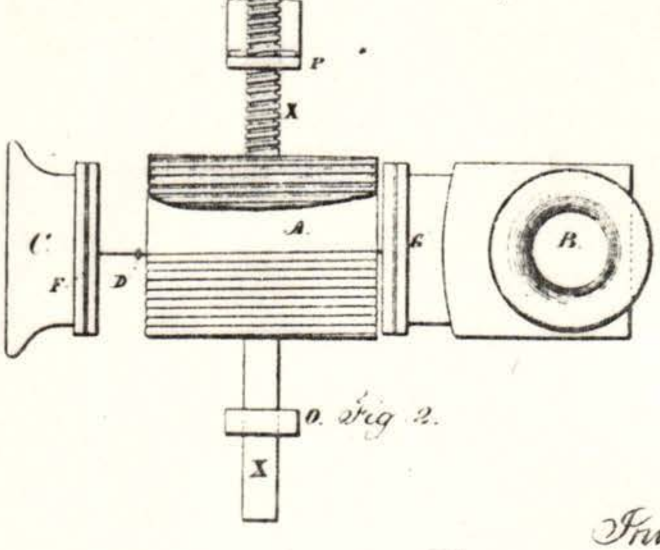


Fig. 2.

Witnesses

Chas. H. Smith
Harold Serrell

Inventor

Thomas A. Edison

per Lemuel W. Serrell
att'y

UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF MENLO PARK, NEW JERSEY.

IMPROVEMENT IN PHONOGRAPH OR SPEAKING MACHINES.

Specification forming part of Letters Patent No. 200,521, dated February 19, 1878; application filed December 24, 1877.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, of Menlo Park, in the county of Middlesex and State of New Jersey, have invented an Improvement in Phonograph or Speaking Machines, of which the following is a specification:

The object of this invention is to record in permanent characters the human voice and other sounds, from which characters such sounds may be reproduced and rendered audible again at a future time.

The invention consists in arranging a plate, diaphragm, or other flexible body capable of being vibrated by the human voice or other sounds, in conjunction with a material capable of registering the movements of such vibrating body by embossing or indenting or altering such material, in such a manner that such register-marks will be sufficient to cause a second vibrating plate or body to be set in motion by them, and thus reproduce the motions of the first vibrating body.

The invention further consists in the various combinations of mechanism to carry out my invention.

I have discovered, after a long series of experiments, that a diaphragm or other body capable of being set in motion by the human voice does not give, except in rare instances, superimposed vibrations, as has heretofore been supposed, but that each vibration is separate and distinct, and therefore it becomes possible to record and reproduce the sounds of the human voice.

In the drawings, Figure 1 is a vertical section, illustrating my invention, and Fig. 2 is a plan of the same.

A is a cylinder having a helical indenting-groove cut from end to end—say, ten grooves to the inch. Upon this is placed the material to be indented, preferably metallic foil. This drum or cylinder is secured to a shaft, X, having at one end a thread cut with ten threads to the inch, the bearing P also having a thread cut in it.

L is a tube, provided with a longitudinal slot, and it is rotated by the clock-work at M, or other source of power.

The shaft X passes into the tube L, and it is rotated by a pin, 2, secured to the shaft, and passing through the slot on the tube L, the object of the long slot being to allow the shaft X to pass endwise through the center or support P by the action of the screw on X. At the same time that the cylinder is rotated it passes toward the support O.

B is the speaking-tube or mouth-piece, which may be of any desired character, so long as proper slots or holes are provided to re-enforce the hissing consonants. Devices to effect this object are shown in my application, No. 143, filed August 28, 1877. Hence they are not shown or further described herein.

Upon the end of the tube or mouth-piece is a diaphragm, having an indenting-point of hard material secured to its center, and so arranged in relation to the cylinder A that the point will be exactly opposite the groove in the cylinder at any position the cylinder may occupy in its forward rotary movement.

The speaking-tube is arranged upon a standard, which, in practice, I provide with devices for causing the tube to approach and recede from the cylinder.

The operation of recording is as follows: The cylinder is, by the action of the screw in X, placed adjacent to the pillar P, which brings the indenting-point of the diaphragm G opposite the first groove on the cylinder, over which is placed a sheet of thick metallic foil, paper, or other yielding material. The tube B is then adjusted toward the cylinder until the indenting-point touches the material and indents it slightly. The clock-work is then set running, and words spoken in the tube B will cause the diaphragm to take up every vibration, and these movements will be recorded with surprising accuracy by indentations in the foil.

After the foil on the cylinder has received the required indentations, or passed to its full limit toward O, it is made to return to P by proper means, and the indented material is brought to a position for reproducing and rendering audible the sounds that had been made by the person speaking into the tube B.

C is a tube similar to B, except that the diaphragm is somewhat lighter and more sensitive, although this is not actually necessary. In front of this diaphragm is a light spring, D, having a small point shorter and finer than the indenting-point on the diaphragm of B. This spring and point are so arranged as to fall exactly into the path of all the indentations. This spring is connected to the diaphragm F of C by a thread or other substance capable of conveying the movements of D. Now, when the cylinder is allowed to rotate, the spring D is set in motion by each indentation corresponding to its depth and length. This motion is conveyed to the diaphragm either by vibrations through a thread or directly by connecting the spring to the diaphragm F, and these motions being due to the indentations, which are an exact record of every movement of the first diaphragm, the voice of the speaker is reproduced exactly and clearly, and with sufficient volume to be heard at some distance.

The indented material may be detached from the machine and preserved for any length of time, and by replacing the foil in a proper manner the original speaker's voice can be reproduced, and the same may be repeated frequently, as the foil is not changed in shape if the apparatus is properly adjusted.

The record, if it be upon tin-foil, may be stereotyped by means of the plaster-of-paris process, and from the stereotype multiple copies may be made expeditiously and cheaply by casting or by pressing tin-foil or other material upon it. This is valuable when musical compositions are required for numerous machines.

It is obvious that many forms of mechanism may be used to give motion to the material to be indented. For instance, a revolving plate may have a volute spiral cut both on its upper and lower surfaces, on the top of which the foil or indenting material is laid and secured in a proper manner. A two-part arm is used with this disk, the portion beneath the disk having a point in the lower groove, and the portion above the disk carrying the speaking and receiving diaphragmic devices, which arm is caused, by the volute spiral groove upon the lower surface, to swing gradually from near the center to the outer circumference of the plate as it is revolved, or vice versa.

An apparatus of this general character adapted to a magnet that indents the paper is shown in my application for a patent, No. 123, filed March 26, 1877; hence no claim is made herein to such apparatus, and further description of the same is unnecessary.

A wide continuous roll of material may be used, the diaphragmic devices being reciprocated by proper mechanical devices backward and forward over the roll as it passes forward; or a narrow strip like that in a Morse register may be moved in contact with the indenting-point, and from this the sounds may be reproduced. The material employed for this purpose may be soft paper saturated or coated with paraffine or similar material, with a sheet of metal foil on the surface thereof to receive the impression from the indenting-point.

I do not wish to confine myself to reproducing sound by indentations only, as the transmitting or recording device may be in a sinuous form, resulting from the use of a thread passing with paper beneath the pressure-rollers *t*, (see Fig. 3,) such thread being moved laterally by a fork or eye adjacent to the roller *t*, and receiving its motion from the diaphragm G, with which such fork or eye is connected, and thus record the movement of the diaphragm by the impression of the thread in the paper to the right and left of a straight line, from which indentation the receiving-diaphragm may receive its motion and the sound be reproduced, substantially in the manner I have already shown; or the diaphragm may, by its motion, give more or less pressure to an inking-pen, *u*, Fig. 4, the point of which rests upon paper or other material moved along regularly beneath the point of the pen, thus causing more or less ink to be deposited upon the material, according to the greater or lesser movement of the diaphragm. These ink-marks serve to give motion to a second diaphragm when the paper containing such marks is drawn along beneath the end of a lever resting upon them and connected to such diaphragm, the lever and diaphragm being moved by the friction between the point being greatest, or the thickness of the ink being greater where there is a large quantity of ink than where there is a small quantity. Thus the original sound-vibrations are reproduced upon the second diaphragm.

I claim as my invention—

1. The method herein specified of reproducing the human voice or other sounds by causing the sound-vibrations to be recorded, substantially as specified, and obtaining motion from that record, substantially as set forth, for the reproduction of the sound-vibrations.

2. The combination, with a diaphragm exposed to sound-vibrations, of a moving surface of yielding material—such as metallic foil—upon which marks are made corresponding to the sound-vibrations, and of a character adapted to use in the reproduction of the sound, substantially as set forth.

3. The combination, with a surface having marks thereon corresponding to sound-vibrations, of a point receiving motion from such marks, and a diaphragm connected to said point, and responding to the motion of the point, substantially as set forth.

4. In an instrument for making a record of sound-vibrations, the combination, with the diaphragm and point, of a cylinder having a helical groove and means for revolving the cylinder and communicating an end movement corresponding to the inclination of the helical groove, substantially as set forth.

Signed by me this 15th day of December, A. D. 1877.

THOS. A. EDISON.

Witnesses:
GEO. T. PINCKNEY,
CHAS. H. SMITH.

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United States Circuit Court,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY, Complainant, 2

vs. In Equity.

THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.

STATE OF NEW YORK, }
County of New York, } ss. 3

Henry B. Brownell, a citizen of the United States, residing at New Brighton, Staten Island, New York, being duly sworn, deposes and says that he has examined the record in the case of the American Graphophone Company vs. Leeds and others, being the case in the United States Circuit Court for the Southern District of New York, and the case wherein was filed the opinion of Judge SHIPMAN, 4
printed in Vol. 87 Federal Reporter, p. 875, and referred to in the moving papers in the above-entitied case and that he finds the following to be a correct copy of the answer of Mr. Arthur S. Browne, one of the witnssses examined on behalf of complainant in said cause, to x-Q. 103, which is found on page 50 of the record in said cause :

> " x-Q. 103. Would not the construction under discussion render the rubbing style 'capable of moving both to and from the surface of the tablet,

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5 and also latterly ? ' A. Perhaps so, but whether or not under the assumed conditions of the style would of itself gravitate to the bottom of the sound grove, as stated at lines 66 and 67 of page 4 of the Bell & Tainter patent, or whether the style would follow and adjust itself to the record, as stated at lines 83 and 84 of page 4 of the Bell & Tainter patent, which functions and offices are essential to the universal joint of the patent, are questions which cannot be determined by me with
6 reference to a hypothetical construction which I never saw or heard of. It is not all joints or constructions which allow movement in two directions at right angles to each other, which constitute the universal joint of the Bell & Tainter patent, the universal joint of the patent, being one which not only has these two movements, but has them in such a fashion as to perform the offices set forth in the patent."

7 Deponent furthermore avers that the following is a correct copy of the answer of Mr. Charles S. Tainter to question 7 found on pages 190-1 of the record :

> " Q. 7. Mr. Benjamin, defendant's expert, says x-Qs. 78, 80) that the liability of a reproducer to lose track of a record groove where there were ten to the inch would be diminished and not increased if the lines were one hundred to the inch. Is he right in that opinion ? A. The difficulty of
> 8 tracking the groove increases as its width and depth diminish.
>
> " With record grooves equal in size and shape, the reproducer will follow a pitch of ten to the inch as readily as it will one of one hundred ; but should the reproducer, for any reason, leave the groove, it might in the case of the course pitch travel along on the surface of the record cylinder between the grooves, while with the fine pitch the space between grooves being too narrow to support the reproducer the motion of the cylinder throws it

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593-4 of the Record :

to one side or the other and into the groove. If, in 9
the case of the coarse pitch, the width of the
groove is made equal to the pitch, the tracking
will be less difficult than in the case of the finer
pitch, as there is no place for the reproducer to
rest outside the groove, and when the groove is
large it is more effective in guiding the reproducer.
A disturbance that would throw the reproducer
out of a fine groove would not interfere with the
tracking of the large one.

"We were for a long time embarrassed in our 10
work by the difficulty of reproducing from a nar-
row and shallow record. On the one hand the
success of the method of engraving depended
upon reducing to a very fine hairlike line the
cross-section of the record groove. On the other
hand, it was utterly impossible, with the repro-
ducing instrumentalities of the time, to reproduce
from such a record. This difficulty was so great
that we gave up for a time all hope of producing
satisfactory results by the rubbing method 11
of reproducing and made numerous experi-
ments with other methods, as by jets
of air and other fluids. After conceiving the idea
of the yielding-pressure reproducer, which brought
us back to the rubbing method, it required a great
number of experiments to determine the construc-
tion of a reproducer which would automatically
track such a fine groove as could be made by the
engraving method and maintain constant contact
therewith at uniform pressure." 12

Deponent further avers that the following is a correct copy of the translation of the "Comptes" Rendus article on the Cros phonograph, being one of defendant's exhibits in said cause, and printed on pages 593-4 of the Record :

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13 "TRANSLATION OF COMPTES RENDUS ARTICLE ON CROS PHONOGRAPH.

Comptes Rendus, Of the Academy of Sciences, Dec., 1877, pp. 1082-1083. Translation.

(Defendant's Exhibit Comptes Rendus Article on Cros Phonograph (Translation) B. B., Jr., Exr.)

Mr. Ch. Cros asked for the opening of a sealed
14 paper, deposited by him April 30, 1877, and bearing title 'Process of registering and reproducing phenomena perceived by the hearing.'

This paper opened during the session by the permanent secretary contains the following note:

In general my process consists in obtaining the tracing of the backward and forward movement of a vibrating membrane and to make use of this tracing in order to reproduce the same backward and forward movement with its intrinsic relations
15 of duration and intensity on the same membrane or on another suitable to render the sounds and noises which result from this series of movements.

It therefore deals with transforming an extremely delicate tracing, such as that which is obtained by means of light fingers rubbing surfaces blackened at the flame, to transform, I say, these tracings into resisting tracings in relief or in grooves capable of conducting a movable part which will transmit its movements to the sonorous
16 membrane.

A light finger is solid with the center of the face of a vibrating membrane; it ends in a point (a metallic wire, down of a quill, etc.) which rests upon a surface blackened at the flame. This surface forms part of a disk, which is animated by a double movement of rotation and rectilinear progression. If the membrane vibrates, the spiral traced will be undulated, and its undulations will exactly represent all the backward and forward

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movements of the membrane, according to their 17
duration and their intensities.

By means of photographic processes now well known, this undulating spiral, traced in transparence, is transferred in a line of like dimension, traced in grooves or in relief on to a resisting material, tempered steel; for example.

This done, this resisting surface is placed in a
motor apparatus, which causes it to turn and pro-
gress with a like quickness and movement to those
which animated the registering surface. A metal 18
point, if the tracing is in grooves (or a notched
finger, if it is in relief), is held by a spring on this
tracing, and at the other end the finger which sup-
ports this point is solid with the center of the face
of the suitable membrane for producing the
sounds. In these conditions this membrane will
be animated no longer by the vibrating air, but by
the tracing commanding the pointed finger by im-
pulses exactly alike in duration and intensities to
those to which the registering membrane was sub- 19
jected.

The spiral tracing represents successive equal times by increasing or decreasing lengths. This will not be inconvenient if only the peripheral portion of the turning circle be utilized, the turns of the spiral being very close together, but then the central surface is lost.

At all events the helical tracing on a cylinder is
preferable, and I am now occupying myself in find-
ing its practical realization." 20

Deponent further avers that the following are correct extracts from the Brief and Argument for Complainant, filed in the case of the *American Graphophone Company vs. Leeds* and others referred to above.

Extract from pages 4 and 5:

"The Self-Adjusting Reproducer.—The merit of this feature of the invention lies not only or mainly in the fact that it does away with all ne-

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21 cessity for adjustment, either laterally or radially, of the record cylinder, and that it insures contact with uniform pressure between the reproducing stylus and the undulating line of the record. Its chief merit lies in the part it played *in the development of the engraving method*."

Extract from page 21:

"The patentees, therefore, discovered and
22 pointed out in their patent that the recording
medium must be highly 'amorphous'—*i. e.*, non-structural; 'slightly cohesive,' so as to yield exactly *at* the point of the style and not at a distance (however minute) therefrom, and 'capable of being readily removed in chips or shavings.' These requisites which are fully set forth in the patent and *nowhere prior thereto*, are those which are characteristic of 'wax and wax-like' materials. Materials of that nature, possessing those charac-
23 teristics, have been used ever since. *None others are in use to-day.*"

Extract from pages 22 and 23:

"In the first place it is to be noted that the engraved record of Bell & Tainter was the *only* sound record that had been produced up to the date of their patent which was capable of any practical use whatever; and the evidence discloses no other sound record in existence at the present day capa-
24 ble of co-operating with the other elements of
claims 22, 23 and 24 for the reproduction of sounds. In determining, therefore, the scope of these claims, we are controlled by the fact that the patent describes no sound record except the *engraved* record, and that none other existed."

Extract from page 23:

"It is material also to consider the character of the sound record for the purpose of determin-

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ing the question of infringement of claims 22, 23 25
and 24. If defendants employed a record that was *not* an engraved record, a different issue would arise, namely, whether those claims could be so broadly construed as to cover such different record."

Extract from pages 24 and 25:

"If the issue here is, as at the argument of the
motion, whether Judge GROSSCUP were right or 26
wrong in assuming the novelty of the Bell & Tainter sound record, we must determine what he meant when he said that the Bell & Tainter sound record was novel.

"This is readily ascertained from his opinion when he describes what he regarded as the important features of the Bell & Tainter invention. He said:

"'The complainants accomplished this by pro-
viding as a substance for the record a compound 27
of beeswax and paraffine, slightly cohesive and amorphous. Upon this was traced, by means of a *cutting* style, connected with the sound-receiving diaphragm, and vibrated by it, grooves, whose vertical undulations corresponded with the vibrations imparted. The style *cutting* these grooves removed all the material necessary to be displaced, and thus left the surface and density of the substance as it was before, except for the
grooves. These grooves were *cut* with sloping 28
walls, into which another style, corresponding with the first, would easily fit.'

"This cut or engraved sound record, having these characteristics, was the sound record *which Judge Grosscup assumed to be new. Defendant's expert and counsel now find themselves obliged to make the same assumption.*

"We have, then, in claims 22, 23 and 24, a combination involving two elements, one of them a

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29 specific sound record, the product of a specific
method of recording, and which is new beyond all
question; the other element being a reproducing
device of particular construction, which, even if
old *per se*, was certainly new in the specified combination."

Extract from pages 48, 49 and 50:

"Having fully considered the novelty of the
30 reproducer, we may consider these claims as if the
sound record alone were in question. At the outset
an issue arises as to what is the character of
the sound record defined by the claims. *Defendants
do not deny that the specific engraved sound
record, in the form of a groove with sloping walls
and having irregularities corresponding to sound
waves, is new.* If *that* be the sound record which
these claims specify, as held by Judge GROSSCUP
in the Amet case, the court need go no farther
31 to reach the conclusion. This is our contention
in the present case. The sound record of this
patent is an article of manufacture now made
and sold by the hundreds of thousands. It
operates in the millions of instances in which
it has and does operate, in conjunction with
the specific self-adjusting reproducer of these
claims and in no other way. In other words, every
one of these instances is a case of the practical use
of the combinations of these claims. Every *time
32 defendants' machine operates it contains one of these
engraved records as an essential operative part.* It
is adapted to that purpose and to none other.
The mandrel is constructed to receive, and the machine
in every detail to operate with, those engraved
records, and with none other.

"Notwithstanding all this, defendants' expert, admitting the Bell & Tainter sound record to be new, holds that these claims are not limited to their special sound record and that they would embrace, for example, such things as the embossed tin-foil record of the old art.

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Subscribed and sworn
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[SEAL.]

"If defendants employed a different sound rec- 33
ord from the commercial *engraved* sound record
made under this patent, a question as to the
breadth of claim would arise, and it would be for
the Court to decide whether claims 22, 23 and 24
are broad enough to include such different con-
struction. But when the defendants' machine is
furnished to be used with the very sound records
made by complainant and its licensees, the Court
will, we think, confine itself to the actual things
before it. This is what complainant's expert has 34
done (see, for example, x-q. 49 *et seq.*, p. 36), de-
clining to express opinions as to the operativeness,
in this combination, of hypothetical records exist-
ing only in the imagination of defendants' counsel.

"In claim 22 the sound record is defined as '*a
grooved tablet* or other body having a sound record
formed therein;' claim 23 defines it as 'the tab-
let or other body having the sound record formed
therein as an *irregular groove with sloping walls*;'
claim 24 defines it as 'a sound record formed in 35
wax or wax-like material.'

"Although none of these claims specify an *en-
graved* record, the specification describes no other,
the industrial art knows no other with which the
defendants' machine could be used, and it is ad-
mittedly made for that use. From these facts it
follows that the claims, which refer to the specifi-
cation, *certainly cover that sort of record*, whether
or not (should a case ever arise presenting that
question) they cover a *different* sort of record." 36

Deponent makes these extracts at the request of defendant's counsel in this case.

HENRY B. BROWNELL.

Subscribed and sworn to be-
fore me this 29th day of
November, A. D. 1898.

L. VREELAND,
Notary Public,
N. Y. Co.

[SEAL.]

[Reprinted from the JOURNAL OF THE FRANKLIN INSTITUTE, June, 1888.]

Mr Alex. Melville Bell
with compliments
of the author

THE GRAMOPHONE: ETCHING THE HUMAN VOICE.

BY EMILE BERLINER.

[*A paper read at the Stated Meeting of the* FRANKLIN INSTITUTE, *May 16, 1888.*]

JOS. M. WILSON, President, in the chair.

THE PRESIDENT introduced Mr. BERLINER, who spoke as follows:

MEMBERS OF THE FRANKLIN INSTITUTE, LADIES AND GENTLEMEN:—The last year in the first century of the history of the United States was a remarkable one in the history of science.

There appeared about that period something in the drift of scientific discussions, which, even to the mind of an observant amateur, foretold the coming of important events.

The dispute of Religion *versus* Science was once more at its height; prominent daily papers commenced to issue weekly discussions on scientific topics; series of scientific books in attractive popular form were eagerly bought by the cultured classes; popular lectures on scientific subjects were sure of commanding

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enthusiastic audiences; the great works on evolution had just commenced to take root outside of the small circle of logical minds from which they had emanated, and which had fostered them. Scientific periodicals were expectantly scanned for new information, and the minds of both professionals and amateurs were on the *qui vive*.

Add to this the general excitement prevailing on account of the forthcoming centennial celebration with its crowning event, so dear to this nation of inventors, the world's exhibition, and even those who did not at the time experience the effects of an atmosphere pregnant with scientific ozone, can, in their minds, conjure up the pulsating, swaying, and turbulent sea of scientific research of that period. Science evidently was in labor.

The year 1876 came, and when the jubilee was at its very height, and when this great City of Philadelphia was one surging mass of patriots filling the air with the sounds of millions of shouts, a still small voice, hardly audible, and coming from a little disk of iron fastened to the centre of a membrane, whispered into the ear of one of the judges at the exhibition, and one of the greatest of living scientists, the tidings that a new revelation had descended upon mankind, and that the winged and fiery messenger of heaven's clouds had been harnessed to that delicate, tremorous, and yet so potent form of energy, called the Human Voice.

The speaking telephone had been born.

The stimulus which this event gave to science can best be measured by the enormous advance made since, especially in that now most prominent branch, electricity, and I will show further on how, immediately following it, our sister republic across the ocean answered the magic touch by the conception of another invention, the scope of which cannot to-day be measured yet, and which only just now is starting on its career of usefulness among the practical arts.

In order to show the influence which these two inventions had upon each other, and how their respective development came about in parallel steps, permit me, before entering upon the new methods which I am to bring before you to-night, to pass in rapid review on the principal events in the history of the

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1156 . 16th Street, Washington, D. C.

transmission of speech electrically, and of recording and reproducing the same mechanically.

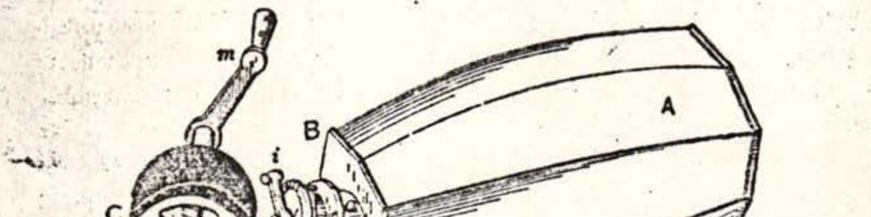
In 1854, Charles Bourseuil, with more than usual boldness, advanced the idea that two diaphragms, one operating an electric contact, and the other under the influence of an electro-magnet, might be employed for transmitting speech over telegraphic distances. "Speak against one diaphragm," he said, "and let each vibration break or make the electric contact, and the electric pulsations thereby produced will set the other diaphragm vibrating, and the latter ought then to reproduce the transmitted sound." Outside of the fallacy which his theory contained in the assumption of breaking the contact, instead of merely modifying the same, Bourseuil's paper, in speaking of the diaphragm, laid stress upon stating that "if one could be invented so movable and flexible as to answer to all the undulations of sound." He evidently desired extreme flexibility, and diaphragms constructed on that principle proved fatal to the efforts of many subsequent experimenters; even at first to Mr. Bell, who, like Bourseuil, borrowed the idea from the flexible *tympanum membrani* of the human ear, and who overlooked the important modifications which the vibrations undergo, before reaching the auditory nerve, by the series of muscular hinges in which the various bony accessories of the ear are mounted, and which act as elastic dampers against the *tympanum membrani.*

Bourseuil's ideas were immediately reprinted from French journals in other countries, and among the first was a prominent German semi-weekly journal, printed in Frankfurt-on-the-Main, *The Didaskalia*, which, on September 28, 1854, under the heading "Electrical Telephony," published a leading article, giving a full account of Bourseuil's ingenious and wonderful conception.

Frankfurt was then a city of about 60,000 inhabitants, and among other institutes of learning, it supported a Physical Society, which counted, at the time of this publication, among its active and most zealous members, an enthusiastic young teacher named Philip Reis, who, five years afterward, actually made an apparatus such as indicated by Bourseuil (who had since died without executing his idea), and which apparatus has since become known as the Reis telephone.

I will not now enter upon any controversy as to the scope of this invention, regarding the possibility at the present day to transmit speech with the same. It may suffice to state that, when the news of the Bell telephone reached the learned men of Germany, some of the very first scientists in Berlin who knew all about the Reis apparatus, doubted the possibility of the performance as represented by the American press. It is also now a matter of history, that in the late decision in favor of Mr. Bell, the United States Supreme Court was unanimous so far as the Bourseuil-Reis apparatus was concerned.

FIG. 1.



Scott's Phonautograph.

While Bourseuil's conception was being digested by Reis, another invention, having also a membrane diaphragm as its motive principle, was patented in France in 1857. This was the phonautograph, by Léon Scott, which had for its purpose the recording of sound vibrations upon a cylinder rotated by hand and moved forward by a screw (Fig. 1). The cylinder was covered with paper, this was smoked over a flame, and a stylus attached to the centre of a diaphragm under the influence of words spoken into a large barrel-like mouthpiece, would trace sound vibrations

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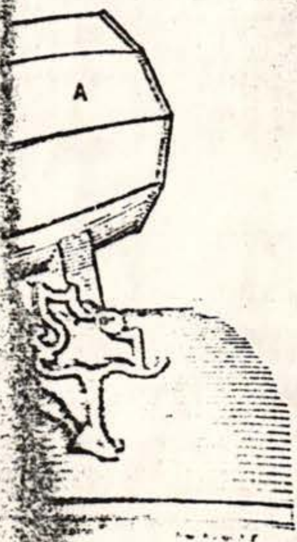

upon the smoky surface. Scott also employed an animal membrane for his diaphragm, and took pains, by means of an attachment called a sub-divider, to make the vibrations appear as large as possible. This sub-divider, however, became the prototype of the dampers in subsequent apparatus, like the Blake transmitter and the Edison phonograph.

The next important event in electro-phonic and acoustic science was the publication by Helmholtz of his investigations in sound, and of König in the same line of research, but classical as these publications will forever remain, they for a time retarded the progress of apparatus for practical use, for the reason that they discouraged inventors by the mechanical complications which they apparently ascribed as indispensable to articulate speech. In fact, the perusal of their work left a serious doubt in the mind of many a student, whether there was not something in articulate speech and its audibility by the human ear, beyond the grasp of the mechanical mind of man.

These doubts were still increased by the attempts of Faber to construct a talking machine, after the system of the human organs of speech, a mass of intricate mechanism, levers, bellows, and pulleys, which gave an unearthly rendition of many words and sentences.

But the Bell telephone came, and its greatness consisted not so much in the fact that it carried speech over hundreds of miles, but that it taught how simple a piece of apparatus could produce such perfect results, and that any diaphragm however thick, could be made to set up audible articulate vibrations.

The effect of this lesson was immediate, for hardly had the new wonder become known when an astonishing chain of logic formed in the brain of a distant devotee to science.

On the 30th day of April, 1877, Mr. Charles Cros deposited with the Secretary of the Academy of Sciences in Paris a sealed envelope, containing what in translation reads as follows:

"PROCESS OF RECORDING AND OF REPRODUCING AUDIBLE PHENOMENA."

"In general, my process consists in obtaining the tracing of the to-and-fro movements of a vibrating membrane, and the utilization of this tracing for reproducing the same to-and-fro movements, with their relative inherent durations and intensities in the same membrane, or in another adapted for furnishing the sounds and noises which result from this series of movements.

"We are, therefore, concerned with the transformation of an extremely delicate tracing, such as that obtained with a delicate stylus rubbing upon a surface blackened by a flame, to transform, I say, these tracings in relief or intaglio, in resisting material capable of guiding a moving body, which transmits these movements to the sonorous membrane.

"A light stylus is connected with the centre of a vibrating membrane; it terminates in a point (metallic wire, the barb of a feather, etc.), which bears upon a surface blackened by a flame. This surface is a part of a disk to which is given a double movement of rotation and rectilinear progression.

"If the membrane is at rest, the point will trace a simple spiral; if the membrane vibrates, the traced spiral will be undulating, and these undulations represent exactly all the to-and-fro movements of the membrane, with their times and intensities."

Up to this point the apparatus as described would represent a modified Scott phonautograph, in which the cylinder is substituted by a flat disk. Mr. Cros then continues:

"By means of the photographic process which, in fact, is well known, this traced, transparent, undulatory spiral is converted into a line of similar dimensions, in intaglio or in relief, in resisting material like tempered steel, for instance.

"This done, this resisting surface is, by means of a motor apparatus, made to turn and to progress rectilinearly with a velocity like that which was used in the registration.

"If the reproduced tracing is in intaglio, a metallic point (and if it is in relief, a notched finger), held by a spring, bears upon the tracing at one end and is connected at the other end with the centre of the membrane adapted for sound reproduction. Under these conditions, this membrane is not any more acted upon by the vibrating air, but by the tracing controlling the pointed stylus by pulsations exactly like those to which the membrane was subjected in recording, both as to duration and intensity.

"The spiral trace represents the successive equal periods by its increasing and decreasing length. There is nothing inconve-

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"In all cases, however, a helical tracing upon a cylinder is much to be preferred, and I am actually engaged in finding a practical embodiment of this."

This paper was only read in open session at the Academy on December 3, 1877, and in the meantime Mr. T. A. Edison appeared with the phonograph.

From what we can learn by published reports, Mr. Edison, some time in the latter part of September in the same year, was at work on an automatic telephone, by which he intended to impress a telephone message upon a strip of tin-foil, and let the indentations thereby produced act upon a variable resistance, such as a lampblack button, and thereby transmit the message over the wire. While one day at work on this, so the report runs, he, perchance, slipped the previously indented slip under the recording stylus which, as in the Scott phonautograph, was connected to the centre of a diaphragm, and then and there occurred the first actual reproduction by mechanical means of words registered before.

The phonograph became then, at once, an accomplished fact, for to such an experienced inventor it must have taken but a moment to mentally cover the cylinder of a Scott phonautograph with tin-foil and to indent the same at right angles to the surface of the cylinder.

Everybody remembers the sensation which the invention produced, and the prognostications which were advanced for it by the scientific press showed that the principle of the apparatus was considered to contain the germ of an ultimate achievement of the most accurate results.

In this respect, as well as in others, there are striking resemblances in the history of the two inventions with which I am dealing.

In both, the original idea emanated from Frenchmen, and both described one process of transmitting, and a different process of reproducing speech. In the Bourseuil telephone there was a contact transmitter and an eloctro-magnet receiver; in the Cros phonograph, a written record and an engraved reproducing groove.

In both inventions the first realization occurred in the United States, and was effected with apparatus representing only the reproducer of the original conception. In the speaking telephone, the reproducing electro-magnet of Bourseuil became also the transmitter of Bell, and in the phonograph, the reproducing groove and stylus of Cros became also the record of Edison. Both the Bell and Edison apparatus were accepted for a time as containing the best mechanical and philosophical principle for the highest attainable results. In both, the aim at the beginning was to produce loud sounds, and both eventually contented themselves with a much fainter voice, which then became more distinct in articulation. Finally, in both inventions, the original transmitter was subsequently resurrected, and found to contain a pointer toward a superior principle as a transmitter and recorder, and it only remains now to use a Scott phonautographic record direct for reproduction in order to complete a parallel with the fact that a contact transmitter can also be used as a telephonic reproducer.

In making these parallels, however, I am aware of the fact that Cros had a better idea of a talking machine than Bourseuil had of a speaking telephone.

The paper of Mr. Cros, which can be found on page 1082, vol. 85, of the *Comptes Rendus* of 1877, appears to have been consigned immediately to obscurity. When ten years later, I filed my patent application for the gramophone, not even the Examiners at the Patent Office knew anything of Mr. Cros, and when I mentioned his name in the first publication of the "gramophone," even those best informed on the subject were surprised. Nevertheless, I considered it a duty to my friends to make the following statement to the Editors of *The Electrical World*, which they published simultaneously with the "gramophone," on November 12, 1887. I said:

"On August 30, of this year, which was three months after the filing of my application for a patent, while in the office of my counsel, Mr. Joseph Lyons, I happened to look through a German scientific book in his possession, and reading up about the phonograph, I came across a remark stating that on April 30,

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1877, one, Chas. Cros, deposited at the French Academy of Science a sealed paper which, when opened and read at a subsequent session during that year, was found to contain a description of the author's idea that a photo-engraved phonautographic record, either in relief or intaglio, might be utilized 'for reacting through a stylus on a diaphragm, and by this reaction ought to reproduce the original sound.'

"Surprised as I was at this discovery, I requested Mr. Lyons to find out through his friends in Paris whether and to what extent Mr. Cros had ever carried his idea into practice, and an answer has since come to the effect that Mr. Cros never put his idea into practical operation.

"Whether he was taken aback by the *éclat* which the phonograph produced soon afterward; whether he became discouraged at the practical difficulties, of which I have found many at the outset of all my experiments; or whether he did not appreciate the peculiar advantage of the phonautogramic method—all this does not appear from the meagre accounts so far to hand.

"But although, viewed in the light of equity, he had virtually abandoned his invention at the time when I independently and without knowledge of his prior idea took up the same subject, the fact remains that to *Mr. Charles Cros belongs the honor of having first suggested the idea of, and feasible plan for, mechanically reproducing speech once uttered.*"

As this statement has never been challenged since it was first made, I presume that it is substantially correct.

If we should attempt to carry out strictly the ideas of Mr. Cros, we would find many obstacles to obtaining practical results, and while undoubtedly the correctness of the general principle could be proved, the effects would not be as good even as those obtained by the original phonograph. Even with the application of the various improvements which I originally introduced, the process requires great care, and while this would not have been an obstacle on account of the great advances made in photo-engraving, I have now abandoned the original process altogether, and have substituted one of great rapidity and simplicity.

But to return to the phonograph, we find this apparatus remained in an unsatisfactory and unfinished condition for nearly nine years.

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consists in engraving or cutting the same in wax, or a wax-like composition; substantially as described."

As a final result of all their labors, there issued in the spring of 1887, the graphophone, the first really practical apparatus of the phonograph type, and which was exhibited to admiring crowds in Washington and elsewhere.

To those who have never heard this instrument, I will repeat what I wrote about its performance in November, 1887, namely, that it appears to be the best instrument to take down business letters or dictations of any kind, in which the recognition matters little, so long as the words can be made out; also, that the reproduced sound is as loud as that of a good telephone message, but that the distortion produced by the engraving is sufficient to make the voice unrecognizable save to a strained imagination. added to a previous knowledge of the author of the voice. The record ground of this machine is a thin pasteboard cylinder covered with wax.

Soon after the graphophone became generally known, Mr. Edison, evidently encouraged by the results obtained in this instrument, took again to experimenting with the phonograph, and, after trying wax covered with tin-foil for indentation, he abandoned that mode of recording, and also settled upon a cylinder of wax and the graving-out process, thus confirming the correctness of Bell and Tainter's conclusions, and the new Edison phonograph and the graphophone appear to be practically the same apparatus, differing only in form and motive power.

I now come to the subject of the evening, the Gramophone.

In my telephonic studies, I had become familiar with all the causes influencing the transmission and reproduction of the voice, and what had at all times struck me as forcibly as anything in telephonic phenomena, was the fact that the self-induction of long iron wires or of polarized electro-magnets acted so detrimentally upon the articulation. Electrical resistance alone would simply have weakened the sound, but self-induction meant retardation, and this distortion of the transmitted waves which varied in length and amplitude. To appreciate fully what an extremely small amount of energy ordinary speech possesses mechanically, let us consider a few well-known facts:

A puff of air, not strong enough to extinguish a candle-flame, when blown across an empty bottle or into a whistle will produce a sound which may be heard over a hundred feet away. The amount of electricity needed to operate audibly a magneto-telephone, is said to be less than one-millionth part of the electricity of a standard Daniel cell.

In considering such and other facts it became evident to me that if such delicate energy, subdivided into maybe several hundred waves, should indent or engrave itself into a solid body, it needed but very slight mechanical resistance to modify considerably the character of the sound vibrations. For what self-induction is to the telephone circuit, the variable resistance which impressible material offers to indentation or engraving at various depths is to the phonograph record sheet. Neither is proportional in direct ratio to the expended energy and must give cause, aside from a reduction in size of the sound characters, also to a distortion of the same.

Your own Prof. Houston, in his learned remarks in the JOURNAL OF THE FRANKLIN INSTITUTE of January, 1888, says:

"The difficulties just pointed out, it would seem, must exist in any instrument, however improved in its mechanical structure, if it make the record on the Phonogram at right angles to the surface thereof. Of course, if a substance was discovered for such a surface, that offered a resistance to indentation exactly proportional to the depth of such indentation, the difficulty would, to a great extent, be removed."

All the experiments which were made with the phonograph and the graphophone, confirmed the correctness of all these assertions, for the louder it was necessary to speak when recording, the less distinct became the articulation of the reproduced sound.

A change for the better was, therefore, to be obtained:

First. By tracing the vibrations, as in the old phonautograph, parallel to the record sheet.

Second. By reducing the resistance offered by the record medium to as near to nothing as possible.

Both principles, although not emphasized, are contained in the Cros document; but for my part, I found that merely smoked surfaces were utterly impracticable, because, if sufficiently black for a photo-engraving, and with the extremely small sizes of

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waves obtained with records that are adaptable for the reproduction of good articulate speech, the record lines were ragged, and, under a magnifying glass, looked like a set of parallel saws whose teeth would form a grating sound, which nearly drowned the articulation.

I observed, however, in my experiments, that the grayish deposit of lamp-black which is obtained from the centre of a kerosene flame was more oily and gave a somewhat sharper line than the deep black deposit caused by smoking with the top of the flame, and this led me to the highly beneficial process of oiling the plate prior to smoking the same, either by applying printers' ink or artists' paint by means of a printers' roller or by brushing oil over it. The smoke would then amalgamate with the oil and forms a *fatty ink* of a rather dry consistency, which, when crossed by a stylus, shows, even under a microscope, a sharply cut transparent line.

I still employ this process for small test plates and prepare them as follows: One part of paraffine oil is mixed with twenty parts of benzine or gasoline. This mixture is poured on and off a glass disk, when the benzine evaporates leaving an extremely thin layer of oil. This is held over a smoky flame and moved to and fro until the surface looks *just* dry. The application of artists' paint with a roller prior to smoking is still better.

I also adopted for the gramophone a disk of glass as a support for the smoke deposit, traced the sound record from below so that the displaced lamp-black should fall down, varnished it after the tracing was done and used this disk as a negative without, therefore, needing a camera or photographic chemicals outside of the chrome-gelatine or chrome-albumen used in developing a raised picture. I would refer, for a detailed account, to the already mentioned issues of *The Electrical World* and the JOURNAL OF THE FRANKLIN INSTITUTE.

The lesson of simplicity which the telephone was continuously preaching caused me at an early day to look for a simpler plan to attain my purpose, and in the specification originally filed by me I said:

"This record (meaning the phonautogram) may then be engraved either mechanically, *chemically*, or photo-chemically." And although for a long time without much hope for success, the purely chemical process of direct etching haunted me continuously, and was repeatedly suggested by others.

But it was easier suggested than carried out, because under the principles of the gramophone the etching ground was to offer practically no resistance to the stylus, and to make one which had no resistance mechanically, but did resist the etching fluid after the tracing was done, was the problem to be solved.

You will readily see, that if we can cover, for instance, a polished metal plate with a delicate etching ground, trace in this a phonautogram and then immerse the plate in an etching fluid, the lines will be eaten in and the result will be a groove of even depth such as is required for reproduction; such a process, of course, would be much more direct and quicker than the photo-engraving method.

In nature provision seems to be made for all the wants of mankind, and confident in this belief, I kept on trying to find a trail which led to promising results, and I have the honor to-night, for the first time, to bring before you this latest achievement in the art of producing permanent sound records from which a reproduction can be obtained, if necessary, within fifteen or twenty minutes, and which can be accurately multiplied in any number, by the electrotype process. It may be termed, in short, *the art of etching the human voice.*

The etching ground which I use is also a fatty ink, and one of the best I have found thus far is made by digesting pure yellow beeswax in cold gasoline or benzine.

Benzine, in a cold state, will not dissolve all the elements of the wax, *but only a small part*, namely, that which combines with the yellow coloring principle, and the resultant and decanted extract is a clear solution of a golden hue, which gradually becomes bleached by exposure to light. The proportions which I use are one ounce of finely scraped wax to one pint of gasoline. The bottle containing the mixture must be repeatedly shaken, and, after the white residue has settled, the clear fluid is decanted or drawn off by a siphon.

I then take a polished metal plate, generally zinc, and flow the fluid on and off, as if I would coat with collodion. The benzine will quickly evaporate, and there remains a very thin layer of wax, iridescent under reflected light, not solid as a coating procontinu-

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duced by immersion in a melted mass, but spongy or porous, and extremely sensitive to the lightest touch.

Partly on account of the too great sensitiveness of a single film, and also as an additional protection against the action of the acids employed in the subsequent etching, I may apply a second coating of the solution, and this double coat I find to answer all requirements.

The protection which this porous or spongy wax affords from the acid, is mostly due to the fact that watery solutions assume the spherical state on the film, while at the lines where the wax is disturbed the acid enters freely, and attacks the metal below.

A difficulty, which only a short time ago appeared insurmountable, was the accumulation at the point of the stylus, while tracing the sound record, of filamentary particles of dust which exist in the wax solution, and which being ever present in ordinary rooms, settle down and adhere to the film. These dust particles are so fine that they cannot, as a rule, be detected by the most searching inspection of the prepared plate; but they become very conspicuous, and a very serious source of annoyance when a long record is being made.

It must be borne in mind that the contact which the tracing stylus makes with the record surface, is obtained by the elastic pressure from a piece of hair-spring backed by a narrow blade of writing paper, and which pressure amounts to about five grains. Therefore, as this stylus passes through the fatty ink or other ground, and traces the fine undulatory line, the dust particles, as well as small portions of the displaced ink or wax adhere to and accumulate at the point of the stylus and are dragged along, and the record thereby becomes blurred and indistinct.

I have discovered an effective means for overcoming this difficulty, and it consists in applying to the record surface a fluid that slightly adheres to the etching ground, and keeps it wet while the record is being made. I have found commercial alcohol to be very effective for this purpose, and it is used by pouring it over the plate just before the sound record is made. The alcohol, of course, immediately commences to evaporate, but not rapidly enough to disappear entirely before the record is finished, and there is no difficulty in adding more alcohol while the plate revolves. Under this condition, the point of the stylus remains perfectly clean, and it seems as if the dust particles had not been present at all.

The theory by which I explain this result is, that the alcohol, so to speak, lubricates both the surface and the stylus, and prevents the adhesion of the filaments to the latter. At any rate, the application is highly beneficial, and the resulting line is so sharp and fine that it has to be widened in the subsequent etching process, in order to permit the acid to bite at sufficient depth. It can also be proved that the resistance of the wax film is decreased by the presence of the alcohol, but when this has evaporated the wax film appears to be in precisely the same condition as before, even showing again the iridescent colors which disappeared on the application of the alcohol.

The film of wax being so thin, it is almost transparent, and if th erecord was made on this it could barely be detected. As, however, it is sometimes desirable to examine the record prior to etching the same, I can smoke the etching ground slightly by holding it high above burning camphor, so as to prevent a heating and melting of the spongy wax, and the alcohol poured afterwards over this smoked surface does not seem to wash off any of the soot particles.

We now come to the important process of etching the record. Etching is done on steel, copper, or brass with nitric acid, perchloride of iron, or with a mixture of muriatic acid and chlorate of potash known as Dutch mordant. In modern photo-engraving nearly all the etching is done on zinc by means of diluted nitric acid, and these materials are preferred on account of their being cheaper than any other, and zinc is a metal easily obtained with smooth and even facings. In etching, however, on zinc, it is necessary continually to brush away the hydrogen bubbles which form and adhere to the lines, and as the etching ground is usually of firm and solid material (like asphaltum, hard wax, pitch, or rosin mixtures) no harm results from the brushing necessary in order to obtain sharp edges along the lines.

Desiring to avail myself of the advantages offered in zinc plates, I soon found that no etching fluid was known that would be to zinc what perchloride of iron was to copper—namely, etch cleanly and without the appearance of hydrogen bubbles. To apply the brushing to the delicate spongy wax film had not been

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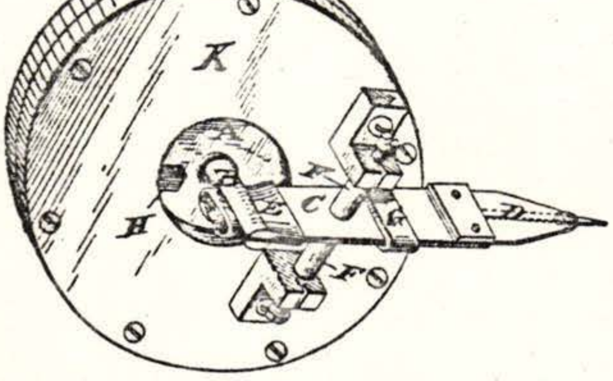
I employed was out of the question, as the first touch would wipe away the whole ground, and to permit the formation of hydrogen bubbles without brushing them away meant uneven and ragged lines and a distorted record.

While studying this matter over it occurred to me to, so to speak, depolarize the zinc plate by adding to the acid, bichromate of soda which I thought might prove efficient, as it does in the galvanic battery, to prevent the appearance of the bubbles while etching the zinc. It took, however, a comparatively large quantity of the bichromate to answer my purpose, so much that I concluded that the mixture had all the conditions of a chromic acid, or at least of a mixture of chromic acid and nitrate of soda. When I thereupon substituted a solution of chromic acid pure and simple, I found this to be a most excellent etching fluid, and that is what I am now using—namely, a solution of one part by weight of dry chromic acid dissolved in three parts by weight of water. I use the commercial acid, such as can be obtained from Churchman & Co., of this city, at twenty-five cents a pound. Such a solution etches on zinc a sharp and clearly cut line, and no hydrogen appears during the etching.

The back of the zinc plate had previously been painted with protecting varnish or molten beeswax, and within from fifteen to twenty minutes from the time of immersion in the chromic acid solution, and without disturbing it a cleanly cut groove of sufficient depth is obtained for reproduction. This groove may then be deepened in the ordinary way of rebiting by covering the facing of the plate with rosin dust, heat the same, and then immerse in diluted nitric acid. Under these conditions the brush may be applied until the necessary depth is obtained, generally in about one to three minutes according to the strength of the etching fluid. I have used stronger solutions of chromic acid with no ill effects and a more rapid etching, and there seems to be a wide margin on this point, provided the plate is watched during the etching process. The lines very gradually widen in the course of the etching, but the upper edges of the grooves remain perfectly parallel and sharply defined.

Before proceeding with a practical demonstration of the whole process, I will now describe the most important apparatus of the gramophone, the recorder. The translation of the movements of the diaphragm into the same movements at right angles, and with the extreme smallness of the motion and the liability of distorting them, adding to them, or detracting from their value in translating them, requires greater care to guard against error than an uninitiated observer would suppose, and when we examine the complex and extremely delicate mechanism which nature has provided in the human ear for giving a correct translation of air vibrations into nervous vibrations, it behooves us to be careful in the application of every day mechanics. Free as the telephone is, comparatively, from mechanical incumbrances, it is deficient in articulation of the consonants, and with the simplicity of mounting as required in the phonograph and graphophone, these difficulties of recording proper do not exist, and are shifted to the other portions of their construction and manipulation. In having attempted, therefore, to do justice to all sources of error I am not yet prepared to say that my present recording apparatus is constructed and adjusted to the greatest attainable correctness. Those who are familiar with the tediousness of original research will admit that a new subject of this kind cannot be solved in its entirety within the space of a few months, and what I bring before you to-night being the hasty results of a new machine finished but ten days ago, should be measured rather by the possibilities it opens, than by the results so far attained, whatever merit you may accord to them.

FIG. 2.



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My impression, however, is that there is very little of lost or added motion in my present apparatus, and whatever imperfections may exist must be looked for in the mode of reproducing the sound, rather than in the recorder (Fig. 2).

K is the diaphragm box; *A* is the centre portion of the diaphragm; *B* is a brass post screwed to the diaphragm and slotted above; *E* is a piece of rubber tubing held in the slot and holding one end of the stylus *C*. This stylus is made of stiff metal and is pivotted by the steel pivots *F F*. *D* is a blade of writing paper reinforced by a piece of hairspring which extends, and forms the tracing point. *G* is a piece of rubber tubing around the stylus which dampens its musical vibrations; *H* is a piece of felt damper between the diaphragm and the diaphragm box, which acts as a general damping device.

The whole is mounted on a sliding carriage, which is drawn by clock-work across the disk, while the latter revolves at the rate of about thirty revolutions per minute.

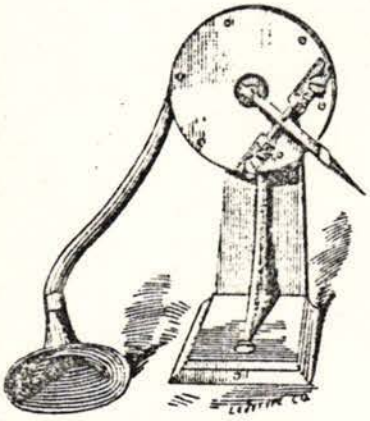
DEMONSTRATION.

While the plate is being etched I will now let you listen to some phonautograms which I prepared in Washington within the last two weeks. The reproducing apparatus, or sounder, is constructed on precisely the same principles as the recorder, but of smaller dimensions and with more rigid mountings, so rigid, in fact, that if it was used as a recorder it would barely show undulations on a smoked surface when shouting into it.

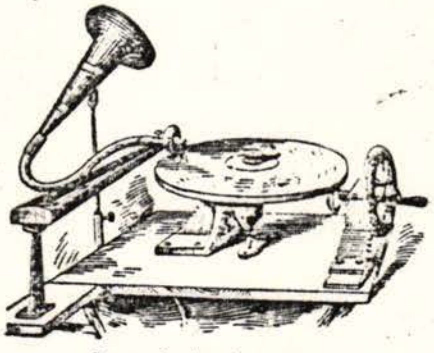
The stylus is tipped with iridium like the points of a gold pen, the object of this being to prevent abrasion by the continuous friction with the hard record.

In reproducing the sound, I find that it is louder with hard contact substances, like metal, than with soft ones like rubber or plaster-of-Paris. Hard metals like copper, nickel, or brass, sound louder than zinc or type-metal, but the scraping sound, which is due to friction, is also increased unless the record surface is smooth and very highly polished.

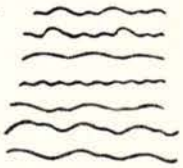
But when an iridium-pointed stylus is rubbed over clean glass a scraping sound is barely perceptible. I am now in communication with a firm that is making ornamental glass tiles by im-



Recording Diaphragm and Stylus.



Reproducing Apparatus.



Record lines (magnified 6 diameters).

pressing upon red-hot glass plates fancy designs in relief or intaglio by strong pressure. You will readily see that if on the same plan we can impress a matrix showing the sound record in raised lines upon a glass plate, we would get a groove, in glass. giving a loud reproduction with a minimum of disturbing sound due to friction.

In the description of November 12, 1887, I advanced the idea of mounting the sounder on a carriage and rails, and have the record groove itself be the screw which was to guide the point of the stylus across the disk from periphery to centre. This has been improved upon by Mr. Werner Suess, the gentleman with me here to-night, and who is the mechanician of our little shop in Washington. He suggested to mount the sounder on a pivot at some distance from the disk and then let the reproducing groove guide the sounder across the disk over an arc of flat amplitude. This happy idea is embodied in the present apparatus, and is a very ingenious adaptation indeed.

REPRODUCTION.

It is, I trust, pardonable if I close by foreshadowing to a certain extent the practical applications of the gramophone.

A standard reproducing apparatus, simple in construction, and easily manipulated, will, at a moderate selling price, be placed on the market.

Those having one, may then buy an assortment of phonautograms, to be increased occasionally, comprising recitations, songs, and instrumental solos or orchestral pieces of every variety.

In each city there will be at least one office having a gramophone recorder with all the necessary outfits. There will be an acoustic cabinet, or acousticon, containing a very large funnel, or other sound concentrator, the narrow end of which ends in a tube leading to the recording diaphragm. At the wide opening of the funnel will be placed a piano, and back of it a semicircular wall for reflecting the sound into the funnel. Persons desirous of having their voice "taken" will step before the funnel, and, upon a given signal, sing or speak, or they may perform upon an instrument. While they are waiting the plate will be developed, and, when it is satisfactory, it is turned over to the electrotyper, or to the glass moulder in charge, who will make as many copies as desired.

The electrotype shells are mounted on thick pasteboard, and this is backed by a stiff piece of sheet metal. There is another process which may be employed. Supposing that his Holiness, the Pope, should desire to send broadcast a pontifical blessing to his millions of believers, he may speak into the recorder, and the plate then, after the words are etched, is turned over to a plate-printer, who may, within a few hours, print thousands of phonautograms on translucent tracing paper. These printed phonautograms are then sent to the principal cities in the world, and upon arrival they are photo-engraved by simply using them as photograph positives. The resultant engraved plate is then copied, *ad infinitum*, by electrotyping, or glass moulding, and sold to those having standard reproducers.

Prominent singers, speakers, or performers, may derive an income from royalties on the sale of their phonautograms, and valuable plates may be printed and registered to protect against unauthorized publication.

Collections of phonautograms may become very valuable, and whole evenings will be spent at home going through a long list of interesting performances. Who will deny the beneficial influence which civilization will experience when the voices of dear relatives and friends long ago departed, the utterances of the great men and women who lived centuries before, the radiant songs of Patti, Campanini, Nieman, and others, the dramatic voices of Booth, Irving, and Bernhardt, and the humor of Whitcomb Riley can be heard and re-heard in every well-furnished parlor?

Future generations will be able to condense within the space of twenty minutes a tone picture of a single lifetime. Five minutes of the child's prattle, five of the boy's exultations, five of the man's reflections, and five of the feeble utterances from the death-bed. Will it not be like holding communion even with immortality?

Postscript: One of the peculiarities inherent with the gramophone is the possibility to enlarge the original sound by enlarging the printed vibratory characters of speech and then photo-engrave ill make as many

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the same. In this manner it should be possible to get the reproduction at a much greater volume than the original sound. It would be interesting if some day speakers in a large hall would prefer to do their talking by machine, or to send speeches to a convention which they were unable to attend in person.

E. B.

[At the close of the paper and after the exhibition of the apparatus, Prof. E. J. HOUSTON moved a vote of thanks to MR. BERLINER for his interesting and valuable communication. The motion was carried unanimously, and the meeting was adjourned.]

A.D. 1878, 24th April. N° 1644.

SPECIFICATION

OF

THOMAS ALVA EDISON.

RECORDING AND REPRODUCING SOUNDS.

PRINTED BY ORDER OF THE COMMISSIONERS OF PATENTS FOR INVENTIONS.

LONDON:
PUBLISHED AND SOLD AT
THE COMMISSIONERS OF PATENTS' SALE DEPARTMENT,
38, CURSITOR STREET, CHANCERY LANE, E.C.

Price 10d.
1878

A.D. 1878, *24th April.* N° 1644.

Recording and Reproducing Sounds.

LETTERS PATENT to Thomas Alva Edison, of Menlo Park, in the State of New Jersey, United States of America, for the Invention of "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

Sealed the 6th August 1878, and dated the 24th April 1878.

PROVISIONAL SPECIFICATION left by the said Thomas Alva Edison at the Office of the Commissioners of Patents on the 24th April 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

My present improvements are for more fully developing and perfecting the device heretofore invented by me, and known as the "phonograph."

By extensive experiment and research I have been enabled to obtain very perfect articulation and to produce a record in a convenient form for preservation.

The sound vibrations are made to move a point that by preference is a diamond or other very hard substance and of a peculiar shape. The sound vibrations in the atmosphere act upon a diaphragm or other body capable of motion, and the same moves the indenting point, and acts as a phonograph. The indented material is properly designated a phonogram, and it is preferably metallic. Sometimes tin-foil is used upon a grooved surface; sometimes a thin sheet or leaf of metal is placed upon a piece of paper having a surface of parafin or similar material.

Sometimes the metallic surface is copper, and where a matrix has been made of steel or iron by electrotype deposit, or otherwise, upon the phonogram it may be hardened and used for impressing a sheet or roller of metal, and thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence, or words, or sounds phonetically.

[*Price* 10d.]

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet."

In order to facilitate production, use, and preservation of the phonograms I employ a ring or margin of thick paper or pasteboard, caused to adhere to the foil or sheet by resinous substance; this is used as a gauge in placing the sheet in the instrument or replacing the same in the phonet. I find that a disc revolved by gearing, and a weight or spring, and the movement regulated by a fan or governor, is a convenient device for presenting the surface to be indented to the phonograph, and the phonograph is on an arm that swings towards and from the centre of the disc, and is guided by grooves or other convenient mechanism.

The phonet device takes the place of the phonograph device when the sounds are to be reproduced.

When the sheet of material is wrapped around a cylinder its edges are passed down into a slit and held firmly. Either the cylinder may be moved endwise by a screw, or the phonograph or phonet devices be moved along the cylinder, and where the same sound is to be reproduced periodically, as calling out the hours of the day in a clock, or reproducing the sounds of animals in toys, the phonet is to be brought to the place of beginning automatically.

The phonographic devices employed by me are preferably a diaphragm of metal, against which the sound vibrations act. Sections of rubber tube applied to the surface act as dampers to prevent false vibrations; pieces of felt or similar yielding material may be used for the same purpose, and a small delicate hoop of spring metal between the diaphragm and the indenting point renders the phonogram more perfect than it would be if the diaphragm acted upon the point direct. A similar effect is produced by a disc upon the arm that carries the point, said disc being so close to the diaphragm that the atmosphere will produce the vibrations.

It is often advantageous to use a case between the mouth of the speaker and the diaphragm to gather or hold the sound, and in some instances the head of the speaker should be inserted into this case, up through a hole in the bottom. The mouth-piece is sometimes slotted or perforated, and has irregular edges to re-inforce the hissing sounds, and sometimes a membrane of rubber or gutta percha is fitted to the teeth, and forms a bag between the lips and the diaphragm.

The disc upon the arm that carries the point as aforesaid may be acted upon by a magnet, and the current through a helix from a diaphragm, or the motion of the arm and points may serve to set up a secondary current through such helix in consequence of the motion given by the phonogram to the point. The arm carrying the point in this latter case should be magnetised.

The phonogram may be produced by the direct action of air concentrated to the spot by a funnel terminating with a small hole, the end of the funnel being almost in contact with the moving surface to be indented.

When the foil is perforated instead of indented it can be rolled up in the form of a horn or cylinder, and revolved, and the articulation result from air blown from the end of a small tube passing through the perforations as they are presented in succession.

Leverage is sometimes employed between the diaphragm and the phonogram, either to lessen or increase the motion of the phonographic action in recording, or of the phonetic action in speaking, and for recording quartette, trio, and other characters of singing, two, three, four, or more phonographic devices are employed upon one cylinder or plate, and the sounds will be reproduced by corresponding phonets; or where singing is conveyed through tubes to one diaphragm the phonographic record will be the combined tones, and the reproduction by the phonet will be complete and correct.

I find that an arm at right angles to a diaphragm, with a point resting upon the phonogram, will reproduce the tones by the weight and leverage of the arm moving the diaphragm.

The phonogram may be in the form of a disc, a sheet, an endless belt, a cylinder, a roller, or a belt, or strip, and the marks are to be either in straight lines, spiral, zig-zag, or in any other convenient form, so long as the apparatus is adapted to bringing the same into contact with the phonet or speaking part of the apparatus, and the reproduction of the phonogram from a matrix or copy in relief of an original phonogram may be made upon a belt, roller, cylinder, plate, or other convenient surface.

For amusement and instruction this phonograph is capable of extended use. For instance, a revolving cylinder containing phonograms of the letters of the alphabet and phonet keys, with corresponding letters on them, can be used in teaching the alphabet; and phonogram sentences, speeches, and other matters can be spoken by the phonet and repeated by the learner without the eyesight being called into use.

For amusement or instruction the phonogram can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, a lion's roar, and the like, and the phonogram can be used in a toy animal with a single phonet for the reproduction of the original sound.

This phonograph or speaking machine applied to a mask produces a semblance of vitality if the phonogram is made to operate upon moveable lips by levers, and in the production of such a phonogram a portion of the surface is to be indented by delicate levers and points, receiving motion from the lips during articulation; thereby a correct reproduction of the motion of the lips is obtained.

In connection with the phonet it is important to avoid the sound that usually results from the rubbing action of the phonogram upon the point. I am enabled to prevent this by an electric action between the point and the phonogram. In this case the phonogram should be of iron, and the point of steel and the parts magnetised so as to slightly repel each other; the point will follow the undulations and reproduce the sounds by the phonet.

It is important that the point used in the phonet correspond in shape to that of the phonograph, but slightly smaller, so as to follow the bottom of the depressions without contact upon the sides.

The diaphragm or other body employed in the phonet to receive motion from the phonogram is connected with a funnel of paper or other resonant substance that acts as a sounding board to render the phonet louder and more distinct.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Thomas Alva Edison in the Great Seal Patent Office on the 22nd October 1878.

THOMAS ALVA EDISON, of Menlo Park, in the State of New Jersey, United States of America. "IMPROVEMENTS IN MEANS FOR RECORDING SOUNDS, AND IN REPRODUCING SUCH SOUNDS FROM SUCH RECORD."

This Invention consists in means for recording in permanent characters the sounds made by the human voice in speaking and singing, those made by musical instruments, birds, animals, or any sound whatever, and in means for reproducing those sounds at any desired time.

The sound vibrations act upon a diaphragm or other body capable of motion; this diaphragm is at the back of a chamber provided with an opening or mouth-piece, and to this diaphragm an indenting point is secured. This instrument I term a "phonograph." The phonograph is adjusted to position with its indenting point contiguous to a moving surface covered with a thin sheet of metal foil or other suitable material, or else the surface with the metal foil is stationary, and the phonograph movable.

The surface upon which the metal foil is secured is by preference grooved spirally, and this indenting point indents the foil in the line of this groove as the diaphragm is moved back and forth by the sound vibrations; these indentations are a record of the sound waves, and form the characters for reproducing the sounds. This indented sheet I term a "phonogram."

The instrument or portion of the instrument that reproduces the sound from the phonogram I term a "phonet." It is similar in construction to the phonograph, being provided with a diaphragm and point, but the mouth-piece is by preference funnel-shaped to render the sound loud and distinct. The sounds are reproduced by the phonet being adjusted to place so that the point of its diaphragm is at the beginning of the spiral line of indentations, and as the surface containing the indented foil is moved the diaphragm of the phonet is vibrated by the point passing from one indentation to the next, hence the diaphragm receives the same movements from the indentations as when making those indentations, consequently the sounds made by the phonet will be the same as those that operated upon the diaphragm of the phonograph.

In the Drawing Fig. 1 is a section of the phonograph and sectional elevation of the mechanism for presenting the surface to be indented; and Fig. 2 is a plan of the same.

The phonograph is made of the body portion *a*, diaphragm *b*, and indenting point *c*. The body portion *a* has a central opening forming the mouth-piece into which the person speaks, or through which opening the sound vibrations pass to act upon the diaphragm, and the diaphragm is secured at its edges to the body *a*, leaving a space between the body and diaphragm in order that the diaphragm may vibrate freely. The indenting point should be a diamond or other very hard substance.

The diaphragm is made of a thin sheet of iron or other material and it is preferable to place the indenting point upon a delicate spring arm c^2, and to employ a short piece of rubber tubing c^3 between the spring and diaphragm; this rubber acts as a damper to prevent false vibrations of the diaphragm.

The phonograph is upon a lever arm *i* pivoted at 5 to the vertical stud [illegible] so that the phonograph may be raised or lowered vertically, or moved horizontally for a purpose hereafter explained.

It is now to be understood that if a person speaks with his mouth near the mouth-piece of the phonograph the sound vibrations will act upon the diaphragm, and vibrate it, and communicate to the indenting point a similar movement, and that if a piece of metal foil or other material susceptible of being indented is placed beneath or behind the indenting point and caused to move regularly, or the indenting point moved over the material; that said material will be indented and form a perfect record of the sound vibrations.

I will now describe the means for sustaining the sheet to be indented, and the mechanism for moving the same:—*d* is a disk or plate secured to and turning with the shaft *c*, and hinged to this disk is a ring frame *f*; this disk *d* has two spiral grooves 3, 4, in its surface. There are pins 2, 2, upon the surface of the disk, and holes at corresponding places in the ring frame; the sheet to be indented is of a size and shape to correspond with that of the disk *d* and frame *f*, and said sheet has holes in it corresponding to the position of the pins 2, 2, and these holes form register marks in placing or replacing the sheet upon the disk *d*, and after the sheet is so placed the ring frame *f* is brought down upon the sheet and holds it firmly in place. There may be a central opening in the indented sheet of a size slightly larger than the space occupied by the spiral 3, and the outer edges of the sheet are stiffened by a ring of thick paper or pasteboard caused to adhere by glue or other adhesive material. The surface of the disk *d* is made with two spiral grooves 3 and 4 as aforesaid; the groove 3 is a guide for a pin that is upon an arm *y* on the phonograph, and the groove 4 is for the indenting point *c*. As the disk and sheet are revolved the groove 3 causes the indenting point to occupy a position immediately over the line of the spiral 4, and the indentations will be made upon the sheet of foil in a line corresponding to that of the spiral 4, shown in Fig. 2. The indentations made in the foil are a complete record of the sound vibrations that acted upon the diaphragm *b*, and from this indented sheet, which I term a "phonogram," the sounds are reproduced. The phonograph is carried outwardly by the spiral 3, and in so doing the parts swing upon the vertical stud 6. By depressing the outer end of the lever *i* the phonograph is raised so that it can be swung aside from the disk *d* to allow of the ring frame *f* being thrown back and the indented sheet or "phonogram" removed from the disk.

The shaft *c* is revolved by a weight, or spring, and gearing at *h*, and the spring is wound up by moving the lever *k* back and forth, which acts upon a ratchet and pawl of ordinary construction; *l* is a lever provided at its outer end with an inclined groove, in which is a pin on the lever *m*, and the other end of this lever *m* is connected with the coupler m^1 by moving the lever *l* one way or the other, the shaft *c* will be connected to or disconnected from the gearing *h*, and hence the disk *d* stopped or started at pleasure without interfering with the motor.

As it is necessary that the shaft *c* should be revolved with uniformity I provide a governor at *n* to prevent the apparatus revolving too rapidly; and this may be made as in Figs. 1, 3, & 4, in which there are metal blocks *o* at the ends of spring arms from a cross head on a shaft that is driven by the gearing *h*, said blocks swinging radially and acting against the interior of a stationary cylinder *p* if the speed becomes too great, thereby checking the speed by the friction of the blocks against the cylinder. These spring arms may be secured at one end to a prismatic block as shown in Fig. 5. It is preferable to cover the surface of the blocks *o* next the cylinder *p* with felt or similar material that will slide upon the interior surface of the cylinder *p*, but produce more or less friction, according to the centrifugal action.

The guide spiral 3 may be dispensed with, and either of the devices shown in Figs. 6, 7, 8, or 9, made use of.

In Figs. 6 and 7 the shaft *c* projects above the surface of the disk *d*, and there is a tooth upon the shaft contiguous to a rack bar extending from the phonograph, hence each revolution of the shaft, the rack bar, and phonograph will be moved the space of one tooth, consequently the lines of indentations will be parallel and concentric to the shaft *c*, excepting at the places when the tooth acts to move the rack bar and phonograph outward or inward. In this case the spiral grooves are cut to correspond to the feed.

In Fig. 8 a worm upon the shaft *c* acts upon a worm pinion to revolve the shaft c^5, and the worm at the other end of this shaft c^5 acts upon teeth around the base of the lever i on the stud 6. By this device the phonograph will be moved outward gradually, and the line of indentations will be in a spiral corresponding to the continuous spiral groove in the plate d.

In Fig. 9 the shaft c is made with a fusee at p^1, and one end of a swinging arm connected to the phonograph takes against the same. The spirals of the fusee gradually move outward the phonograph, as the disk and shaft are revolved, and the line of indentations will be spirally the same as that made by the spiral 3.

In Fig. 10 the shaft c is provided with a screw pinion meshing with teeth upon a cam wheel 7. This gives the same movement to the phonograph as the spiral groove 3.

In Fig. 11 the guide groove 3 for the arm and pin g is upon a disk d^1 upon the shaft c, but the groove 3 occupies the same relative position upon the disk d^1 as the groove 4 upon the disk d, so that the phonograph is moved outwardly by the groove of the disk d^1, swinging both the arms g and i upon the vertical pivot 6.

Instead of the sheet of metal foil being upon the disk d it may be wrapped upon a cylinder q, as in Fig. 12. In this case the cylinder is upon a shaft c^1 revolved by the gearing at h^1, and upon said shaft there is a right and left hand screw at k^1, and there is a corresponding double spiral groove in the surface of the cylinder q. The phonograph is secured to a sliding shaft l^1, and said shaft is moved endwise back and forth by the screw k^1 acting upon an arm m^2 that is secured to the said shaft l^1. As the phonograph is moved in one direction the line of indentations is made spirally in the foil on the cylinder q, and when the arm m^2 reaches the end of the screw it will be moved in the other direction by the reverse screw thread, and the phonograph will make a second spiral line of indentations that will cross the first spiral line. This feature is especially available for a phonet where the surface of the cylinder q is formed of an electrotype or other copy of the phonogram, so that the words or sounds may be reproduced automatically and at intervals if desired.

It is preferable to make use of a thin metal plate n^2, see Figs. 13 and 14, pivoted at one end and fitting within a longitudinal groove in the surface of the cylinder q for securing the edges of the metal foil and holding it securely upon said cylinder. The top of this plate n^2 is flush with the surface of the cylinder, and grooved to correspond with the groves in the cylinder, so as not to interfere with the indenting point. A wire may replace this device, such wire being secured by arms at each end of the cylinder, and raised and lowered in and out of the groove by a cam or otherwise. I find that an interruption of one-eighth of an inch space where there is no recording is not detected by the ear.

The apparatus shown in Figs. 13 and 14 is similar to that shown in Fig. 12, except that the phonograph is stationary and the cylinder moves horizontally, and the shaft c^1 is only provided with a screw thread in one direction, hence the cylinder will have to be moved back by hand to bring it to place if desired to reproduce the sounds from the phonogram, or to position the phonograph if a new sheet of foil is to be indented after the first one has been removed. This is readily accomplished by raising the arm o^1 and its tooth from the screw k^1, which leaves the shaft c^1 and cylinder free to be moved back and forth.

In Fig. 15 the phonograph is fitted to move horizontally instead of the cylinder q, as in Fig. 12, but the shaft c^1 is provided with a screw thread in one direction only, hence the phonograph has to be positioned by hand after the arm o^1 has been raised from the screw k^1.

In Figs. 12 and 15 the phonograph can swing upon the shaft l^1 to raise the indenting point from the cylinder q, and allow for the removal or insertion of a sheet of foil, and there is a stop at 8 for adjusting the position of the phonograph when brought down to indent the foil.

In Figs. 13 and 14 the phonograph is upon an arm pivoted at 9, so that it can be swung horizontally away from the cylinder q for the purpose aforesaid, and the adjustable stop 8 is also provided.

Thus far I have described the "phonograph" or instrument upon which the sound vibrations act, and which instrument acts to indent the sheet of foil and produce the "phonogram" or record of such sound vibrations.

Mechanism has also been described for presenting the sheet of foil to be indented by the phonograph.

I will now describe how the sounds are reproduced from the phonogram.

If it is desired to reproduce the sounds from the phonogram in the same instrument in which the phonogram was produced it is only necessary that the indenting point *c* be made to traverse the line of indentations in the phonogram, and that a funnel-shaped mouth-piece, shown by dotted lines in Fig. 1, be added to the phonograph to aid in increasing the loudness and distinctness of the sound. The instrument in this form I term a "phonet."

In the instrument shown in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, 14, and 15, the phonet requires to be positioned by hand, as before explained, in order that the point *c* may be placed at the beginning of the spiral line of indentations. As the point *c* passes from one indentation to the next, either by the foil being moved beneath said point, as in Figs. 1, 2, 6, 7, 8, 9, 10, 11, 13, and 14, or by the point moving over the foil, as in Figs. 12 and 15, the diaphragm *b* receives a movement corresponding to the depth of the indentations, and corresponding also with the same movement it received from the sound vibrations when making those indentations, hence air waves will be produced by the movement of the diaphragm that will make sounds by passing through the mouth-piece of the phonet that will be exactly the same as the sounds that acted upon the diaphragm of the phonograph.

The material upon which the record is made may be of metal foil, such as tin, iron, copper, lead, zinc, cadmium, or a foil made of composition of metals.

Paper or other materials may be used, the same being coated with parafine or other hydrocarbons, waxes, gums, or lacs, and the sheet so prepared may itself be indented, or the material, say paper, may be made to pass through a bath of hot parafine and thence between scrapers. Thin metal foil is now placed on the material, and the sheet passed through rollers, which give it a beautiful smooth surface. The indentation can now be made in the foil, and the parafine or similar material, and the indenting point, does not become clogged with the parafine in consequence of the intervening foil.

If the copper foil, or tin foil with copper surface is used, and a matrix of iron or steel made by electrotype deposit or otherwise upon the phonogram, such matrix may be hardened and used for impressing a sheet or roller of metal as hereafter mentioned; thereby the original phonogram can be reproduced indefinitely in metal that may be hardened and used for any reasonable length of time to utter the sentence or words or sounds phonetically.

I will now briefly describe some modifications in the construction and operation of the phonograph and phonet.

In Fig. 16 the indenting point *c* is upon a spring arm c^2, as in Figs. 1 and 2, but there are short sections of rubber tube c^3 at each side of the diaphragm *b* to dampen the diaphragm and prevent false vibrations.

In Fig. 17, the rubber of the diaphragm acts against the outer end of the arm c^2 to increase the leverage and lessen the depth of indentations in the foil and allow of the record being made in less yielding material than tin foil.

Fig. 18 shows a modification of the last-mentioned device, the pressure being applied to the arm c^2 between the indenting point and the support for the arm so as to increase the depth of the indentations.

Fig. 19 shows the arm c^2 made as a lever with a spring.

Fig. 20 shows the indenting point upon the center of a spring bar that is firmly held at each end; the bar is connected at its center to the diaphragm *b* by a string or otherwise.

Fig. 21 represents the diaphragm *b* as of concave form instead of flat.

Fig. 22 shows the indenting point upon a spring secured to the diaphragm.

Fig. 23 shows a disk upon the spring c^2 of the indenting point: this disk is placed quite close to the diaphragm and is moved by the air as the diaphragm is vibrated, the disk being so close to the diaphragm that the two will vibrate together, as air cannot pass between or escape as rapidly as the vibrations take place.

Fig. 24 shows the diaphragm vibrated by electro-magnetism; in this case the diaphragm is to be of iron, and the power of the electro-magnet will be varied by a rise and fall of electric current passing through the helix of the electro-magnet; this rise and fall of electric tension is to be produced by the action of sound upon a diaphragm and connections in an electric circuit.

Fig. 25 shows the method of vibrating the indenting spring and point by the direct action of an electro-magnet without the use of a diaphragm, the electric tension in the helix being varied by sound vibrations upon a diaphragm.

Fig. 26 shows the spring arm c^2 connected to one end of a permanent magnet so as to highly magnetize the reproducing point; the foil should be of iron. When the point passes an indentation there will be less attraction than when passing no indentation; this will give good articulation free from the scraping noise of the point on the foil, for in this case it does not touch the foil, but is worked by magnetic attraction.

Fig. 27 represents two instruments in connection with the cylinder *q*; in this case the phonet and the phonograph are separate. The phonograph records in the usual manner, but the phonet has its diaphragm set in motion by the rise and fall of the lever c^2. This reduces the scraping noise of the foil and acts by leverage, and a slight tension to move the diaphragm as the phonogram is moved beneath the point *c*.

Fig. 28 shows an arrangement whereby four persons may speak simultaneously and have records made in separate parallel lines upon one cylinder, and the phonogram will reproduce the sounds the same as though it contained the record of but one voice.

Fig. 29 shows a single phonograph adapted to receive the voices of three persons as in singing; the sounds made by the three voices are conveyed through flexible or other tubes to the diaphragm, and will be recorded in a single line of indentations, but when reproduced by the phonet the sounds uttered will correspond to the three voices.

In Fig. 30, the foil is sustained upon a hollow cylinder with a funnel-shaped end. The record is made upon the foil in the usual manner by the phonograph, excepting that holes are made entirely through the foil. A nozzle with a small opening is placed so that it will always be opposite the line of perforations as the cylinder is revolved. This nozzle is connected to a source of compressed air or other fluid, and every time a perforation comes opposite the nozzle, a puff of air passes into the cylinder and a sound is produced upon the principle of the siren. The nozzle may be placed on a spring to keep the end of the nozzle in contact with the line of perforations.

Fig. 31 shows the phonograph as made with a large chamber between the diaphragm and the mouth-piece; this is especially useful in collecting sound when the person speaking or the sound to be recorded is made several feet from the instrument.

Fig. 32 shows a device whereby the indenting point may be dispensed with in the phonograph. The funnel forming the phonograph is made with a diaphragm at the larger end or mouth-piece, and a very small hole at the pointed end adjacent to the foil on the cylinder *q*; this foil should be very thin so that the indentations will be made by the direct action of the air waves as concentrated by the funnel without the interposition of the indenting point.

Fig. 33 shows a phonet in which the phonogram or sound record has been made upon an endless belt; this is a convenient arrangement for toys, as the same may be made to imitate the bark of a dog or other noise made by an animal; and this belt may be of steel or other hard material that allows the same to be used for a long period of time.

Fig. 34 is a perspective view showing a double phonet, there being a spiral line of indentations on each side of the revolving disk *d*, one phonet coming into action as the other finishes; in this case the spirals should be in opposite directions, so that the disk continuing to revolve in the same direction moves one phonet from the center outwards, and then the other phonet is connected and moved back towards the center; this may be used as a toy.

Fig. 35 represents a phonet in which the phonogram containing a sentence, speech, words, or other sound record is upon a belt or strip wound upon a reel; this belt is drawn along gradually and wound upon the second roller by any suitable mechanism, and as the phonogram is thus moved it actuates the phonet *c*, *b*.

Fig. 36 shows a phonograph or phonet similar to that shown in Fig. 12, the cylinder *q* is revolved, but remains in one positson, and the phonograph or phonet is movable back and forth over the cylinder. In this instance the arm m^2 is extended beyond the screw k^1, and passes beneath the inclined spring guide m^5, when the screw is carrying the arm and phonograph towards the right; as the arm m^2 passes from beneath the end of the guide m^5 it is no longer held to the screw, and the arm m^2 and phonet are lifted by the guide m^2 as the springs m^6 draws the shaft, phonograph, and arm, along to the place of beginning, at which place the arm m^2 drops off the end of the inclined guide m^5 into the thread of the screw, and as this revolves it carries the arm along beneath the guide m^6 as before.

Fig. 37 represents the phonograph or phonet upon a pivoted arm, so that it may swing across or at right angles to the line of movement of the intended material or phonogram. In this case the line of indentations may be lengthwise of the belt, or across the same in the arc of a circle.

Fig. 38 shows a phonograph similar to that shown in Fig. 31, except that the sound chamber is of a different shape.

Fig. 39 shows a mouth-piece with an orifice of soft rubber to fit the mouth or the lips of the person speaking, so that all sound waves will be confined to the chamber and diaphragm.

Fig. 40 shows the mouth-piece of the phonograph made with cross slots with irregular edges.

Fig. 41 shows the mouth-piece as perforated with numerous holes.

Fig. 42 shows but one opening in the mouth-piece; the edges of this are irregular. These irregular edges reinforce the hissing sounds and cause a more perfect phonogram to be produced.

Fig. 43 represents a mouth-piece of mica with a central opening protected at its edges by a wooden ring.

In Fig. 44, the diaphragm *b* is of wire gauze with a backing of paper connected to it by any suitable cement, and there is a ring of stiff paper at the edges of the gauze disk to strengthen it.

Fig. 45 represents a diaphragm *b* of parchment or similar material stretched tightly within the frame b^6 by cords and screws. The cords may be of different lengths and tension, and respond to and reinforce certain sounds.

Fig. 46 shows a mouth-piece for the phonet made in imitation of the human mouth.

Fig. 47 represents the body portion of the phonograph or phonet made triangular, and the diaphragm is of corresponding shape.

Fig. 48 represents three cylinders, each provided with a phonograph or phonet; this is useful in recording and reproducing three-part singing or music.

Fig. 49 represents a phonet made as a tube, with flaring or trumpet shaped ends, and with two diaphragms 15, 16, placed crosswise of the tube so as to form an air chamber. There is a third diaphragm *b*, which is vibrated by the movement of the reproducing point *c*, and said diaphragm gives motion to the air in the chamber, and vibrates the diaphragms 15, 16, which latter produce air waves, and the sounds issuing from the two trumpet-shaped ends will blend and increase the volume of sound.

Fig. 50 represents a device whereby deep indentations are made in the metal foil. Two diaphragms are employed, the first (b^2) is vibrated by the sound vibrations, and controls a valve b^7 in a tube connected with a source of compressed air or other fluid; this valve b^7 allows more or less air to pass to the diaphragm *b*, according to the vibration of the diaphragm b^2, hence the diaphragm *b* will vibrate in harmony with the diaphragm b^2, but it will be acted upon by greater force, and consequently the indentations will be deeper in the foil than if the diaphragm *b* was acted upon simply by the sound vibrations of the voice.

Figs. 51 and 52 represent a device that may be used with a phonet to increase the loudness of the sounds reproduced. The sound vibrations from the phonet are conducted by a tube shown by dotted lines in Fig. 51, to the diaphragm b^3 that controls a valve b^7 in a tube connected with a reservoir of air or other fluid under pressure, and the air as it escapes by the valve passes into the trumpet-shaped end of the tube, and produces sounds that are very loud and clear, and are a reproduction of the sounds resulting from the use of one of the phonets before described.

This same apparatus may be used to reproduce with louder utterances a person's voice, the the sound from the voice being used to vibrate the diaphragm b^3, and thereby regulate the air waves escaping from the valve b^7 into the trumpet.

Fig. 53 shows the speaker's head within a box or case; in this instance nearly all the sound vibrations act upon the diaphragm.

Figs. 54 and 55 illustrate how the movements of the lips in speaking may be recorded and reproduced. In this instance, a lever applied to the diaphragm carries the indenting point *c*, Fig. 55, and the end of this lever is placed in the mouth of the speaker, and the movement of the lips regulates the indentations in the foil.

A similar apparatus shown in Fig. 54 within a case is connected to the movable lips of a mask, so that these lips open and close as in articulation, at the same time that the sound vibrations are given by the phonogram to the phonet.

Fig. 56 represents a toy phonet in which the phonogram strip 35 is secured at one end to a cylinder upon which it is wound. By pulling upon the strip it is unwound, and a rubber cord 37 is wound upon the shaft of the cylinder. When the hand is removed from the indented strip, the rubber cord rotates the shaft and winds up the phonogram upon the cylinder, and the sounds are reproduced in the phonet by the phonogram acting upon a point and diaphragm *a*. The movement of the shaft is regulated by the fan, worm, and pinion 38.

In Fig. 57, the cylinder for moving the phonogram strip is shown as provided with pins that enter holes in the edges of the strip; this causes the strip to be fed along very regular.

In Fig. 58, the cylinder with pins is shown as made with heads to act as guides for the strip.

Fig. 59 shows a re-indenting device for amplifying or increasing the size of the indentations. There are two rollers, one of which a^4 travels faster than the other a^5, and there is a lever 40 pivoted at 41, and provided with a point *c* for each cylinder. One point follows the indentations in the cylinder a^5, and the other rests upon a^4, and as this travels the fastest, the indentations made therein will be longer and also deeper by the point being at the outer end of the lever.

In Fig. 60, one roller 42 of the pair is made of hardened metal with the sound record in relief. This is obtained by electrotype or other process from an iron foil or other metal phonogram, and this roller is used to indent strips or sheets of foil or rollers to produce copies that can be used with the phonet.

Fig. 61 represents a roller 42 of hardened metal with the record in relief, and arranged so as to knurl or indent the phonogram in a roller 43 of soft metal that is to be pressed against the roller 42 by a screw or other suitable means.

The cylinder having a spiral groove in its surface may be made by placing the mould shown in Fig. 62 around a cylinder or shaft, and filling the space between the cylinder and mold with plaster of Paris or other suitable material. The mold is of metal with a screw or spiral rib projecting therefrom, and it is made in two parts and hinged so that it can easily be removed when the plaster of Paris is dry.

For amusement or instruction, the phonograph is capable of extended use; for instance, a revolving cylinder, see Fig. 63, containing rows of indentations representing the letters of the alphabet, and provided with keys containing corresponding letters, can be used in teaching the alphabet, and sentences, speeches, and other matter can be spoken by the phonet, and repeated by the learner without the eyesight being called into use.

Clocks may be provided with phonogram cylinders or wheels to call off the hours, to give alarms, &c.

The phonogram may be upon a strip, sheet, belt, or roller and it can be of a dog's bark, a rooster's crow, a bird's song, a horse's neigh, and these can be used in toy animals with a simple phonet for reproducing the sound.

In copying phonograms, or making duplicates, an original phonogram may receive a deposit of copper or iron in a plating bath; and, if of iron, may be carbonized to convert it into steel and hardened, and then the same should be backed up with type metal, and used for impressing strips or pieces of metal.

A bed of gutta percha, or similar material, may be used to sustain the sheet metal while being pressed. Numerous copies of the original phonogram can thus be reproduced.

A plaster cast can be used for producing a copy by pressure.

The governor to regulate the speed of the instrument may be made of a pendulum weight 61, see Fig. 64, hung at the lower end of a rod that is provided with a universal joint at 62, and the upper end of the rod is moved around by a crank 63 that is revolved by the train of gearing. As the speed increases the weight will describe a circle of larger diameter, and thereby increase the resistance.

The universal joint may be displaced by a spring wire, Fig. 65, that allows of the movement.

A magnet 64 upon the crank arm 63, Fig. 66, may be used to revolve the pendulum by attracting an armature at the upper end of the pendulum rod, and thereby avoid the friction resulting from the contact of the surfaces of the pendulum rod with the crank.

In Fig. 67 the diaphragm *b* is represented as connected to a pair of delicate piston valves within a tube 68 that has three ports; one, 69, is connected to a reservoir of compressed air, the others, 70 and 71, are connected to a number 72 at opposite sides of a diaphragm, so as to vibrate the same in harmony with the diaphragm *b*, but there will be greater amplitude given to the same by the pressure of the air, and by a connection to the phonet diaphragm b^2 the sound produced will be greatly increased.

What I claim as my Invention is,—

First. The combination with the diaphragm and point of a flat receiving surface and means for revolving the receiving surface, and causing the point to follow a volute or spiral line, substantially as represented in Figs. 1, 2, 6, 7, 8, 9, 10, and 34.

Second. The combination with the revolving plate phonograph or phonet of a propelling weight or spring and a governor to regulate the speed, and ensure uniformity of movement, substantially as set forth.

Third. A revolving disk provided with a clamping frame to secure the foil or other material in combination with the swinging arm, diaphragm, and point, substantially as specified.

Fourth. In a phonograph or phonet, a spring introduced between the diaphragm and the point, substantially as set forth and shown in Figs. 16, 17, 18, 19, 22, and 26.

Fifth. In a phonograph or phonet a rubber spring, or similar device, to dampen the vibration of the diaphragm, and prevent false vibrations, as set forth and shown in Figs. 16 and 21.

Sixth. The combination with the diaphragm in a phonograph or phonet apparatus of a lever to modify the relative action of the diaphragm and point, substantially as described, and shown in Figs. 17, 18, 27.

Seventh. The combination with the diaphragm and point of a permanent or electro-magnet, substantially as described, and represented in Figs. 24, 25, 26.

Eighth. The method of recording and reproducing two or more sounds or speeches simultaneously, substantially as described, and as illustrated by Figs. 28, 29, and 48.

Ninth. A phonet composed of a perforated sirene and a jet tube, substantially as described, and represented in Fig. 30.

Tenth. The mechanism for producing a phonogram, and employing the same in a phonet, substantially as described, and illustrated in Figs. 32, 33, 35, 36, and 37.

Eleventh. The combination with the phonograph, diaphragm, and point of a sound chamber, substantially as described, and illustrated in Figs. 31, 38, 39, and 53.

Twelfth. The diaphragm and mouth-pieces for speaking phonograph, substantially as described, and as illustrated in Figs. 41, 42, 43, 44, 45, and 46.

Thirteenth. The combination with a diaphragm and its point of two diaphragms for the purposes, and substantially as shown in Fig. 49.

Fourteenth. The combination with a diaphragm and valve actuated by sound vibrations a source of compressed fluid and a trumpet, as in Figs. 51, 52, or a phonograph as in Fig. 50, substantially as set forth.

Fifteenth. The combination of two diaphragms with a valve and a source of compressed fluid, as represented in Fig. 67, for increasing the volume of the voice or other sound, as set forth.

Sixteenth. The combination with two or more phonograms of phonet keys for selecting letters or utterances as described, and illustrated in Fig. 63.

Seventeenth. The means for duplicating or reproducing phonograms from an original phonogram, substantially as set forth.

Eighteenth. The combination with the phonograph or phonet of the revolving crank and pendulum governor, substantially as described, and shown in Figs. 64, 65, 66.

Nineteenth. The combination with the phonograph of a lever moved by the lips, and of a lever and phonet to move the lips of a mask, substantially as described, and illustrated by Figs. 55 and 54.

Twentieth. The combination with a phonogram of a clock movement or toy and a phonet for reproducing sounds for clocks or toys, substantially as set forth.

In witness whereof, I, the said Thomas Alva Edison, have hereunto set my hand and seal, this 17th day of September, A.D. 1878.

THOMAS ALVA EDISON. (L.S.)

Witnesses,
Chas. H. Smith,
76, Chambers St., New York,
Harold Serrell, 76, Chambers St., New York.

LONDON: Printed by George Edward Eyre and William Spottiswoode,
Printers to the Queen's most Excellent Majesty.
For Her Majesty's Stationery Office.

1878.

A.D. 1878. April 24. No. 1644.
EDISON'S Specification.

FIG. 1.

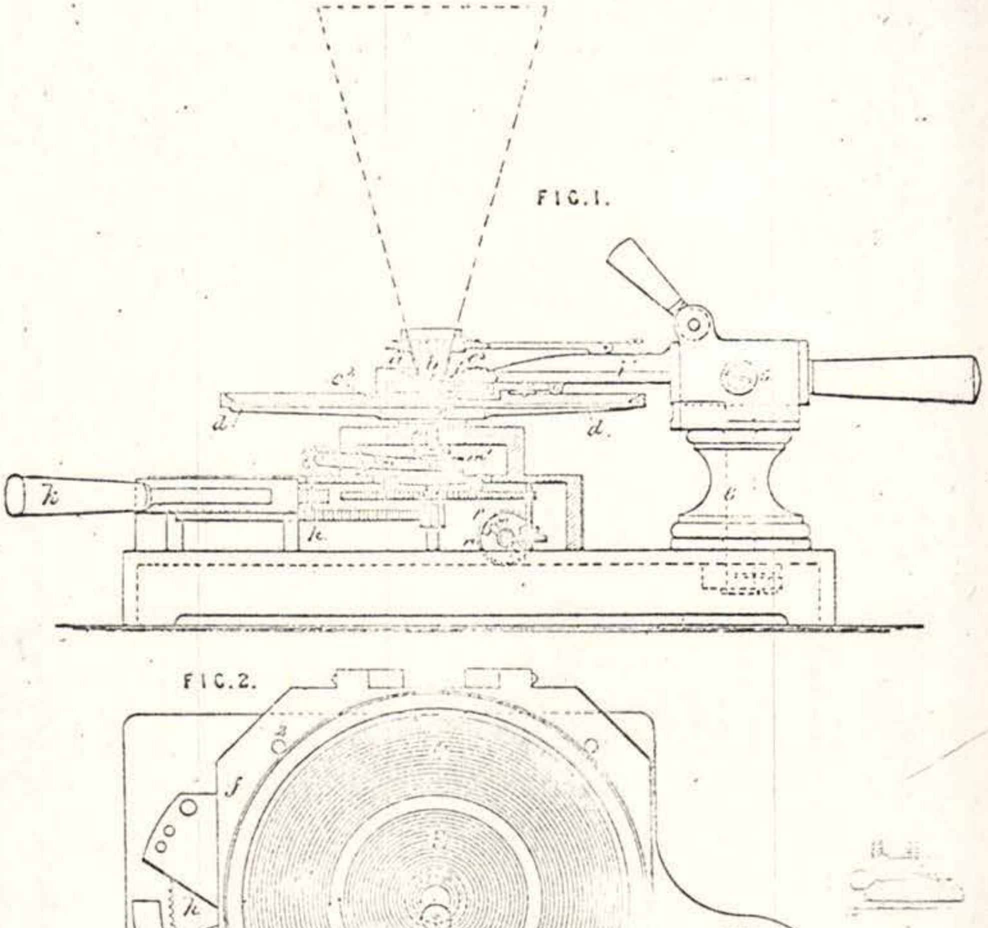

FIG. 2.

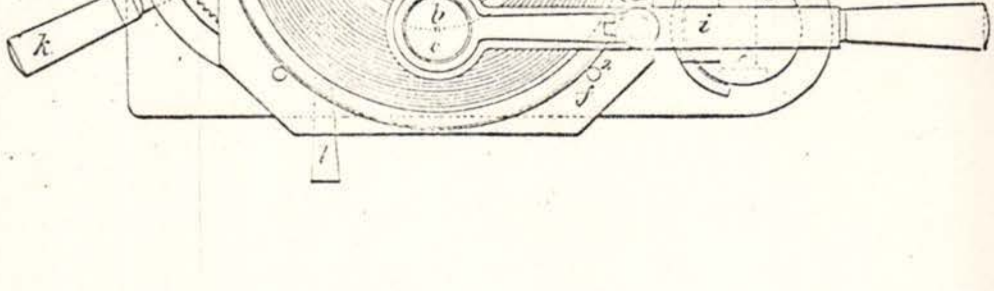

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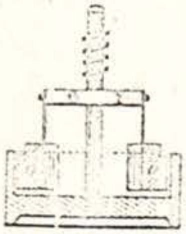
FIG.4.



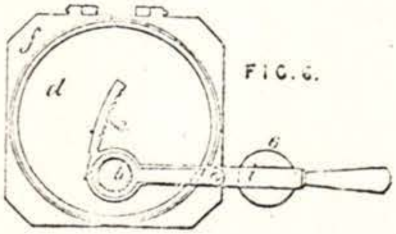
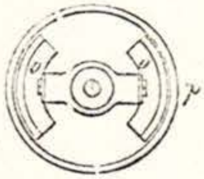


FIG.6.

FIG.3.



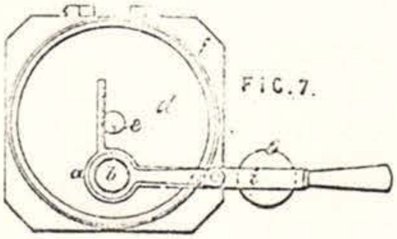


FIG.7.

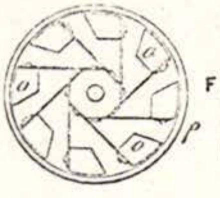


FIG.5.

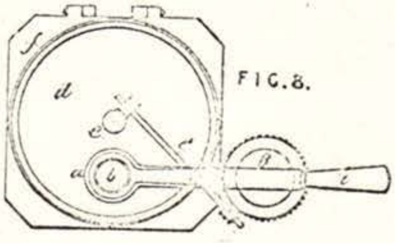


FIG.8.

FIG.10.

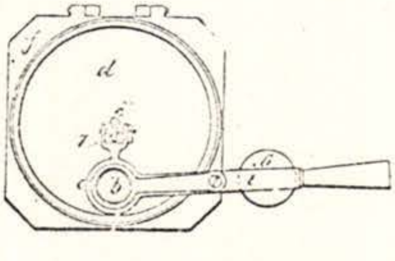
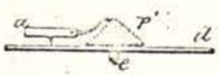


FIG.9.



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EDISON'S Specification.

FIG. 11.

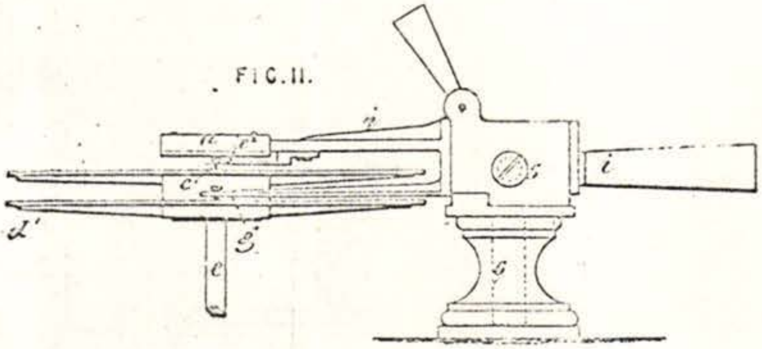

FIG. 12.

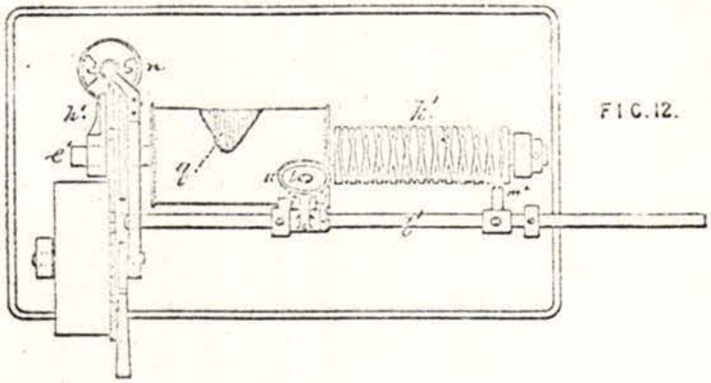

FIG. 13.

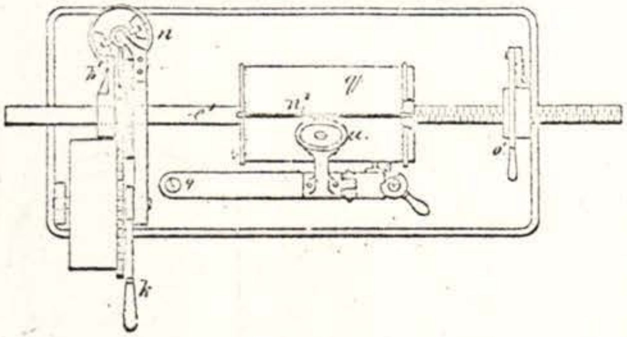

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FIG. 14.

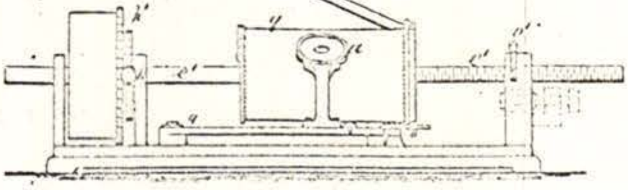


FIG. 15.

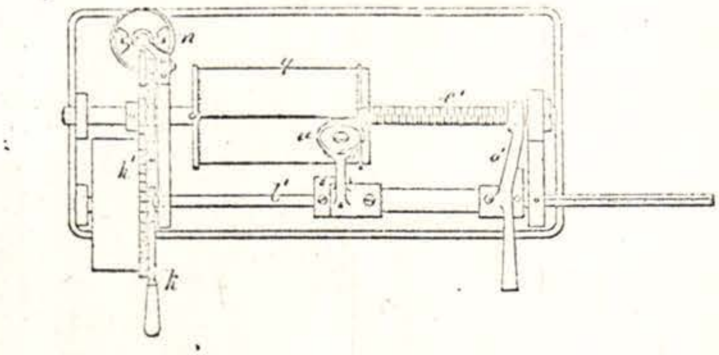


FIG. 16.

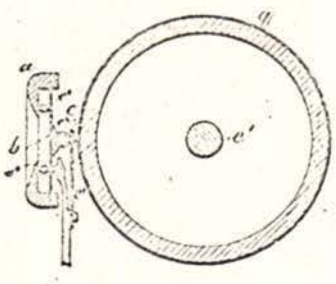


FIG. 17.

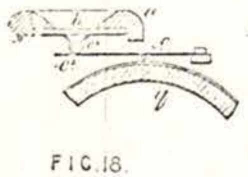
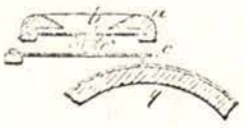


FIG. 18.



Edward Eyre and William Spottiswoode
the Queen's most Excellent Majesty. [illegible]

A.D. 1878. April 24. No 1644.
EDISON'S Specification.

FIG. 19.

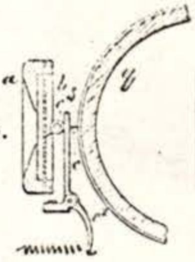


FIG. 20.

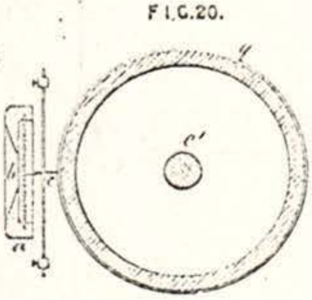


FIG. 21.

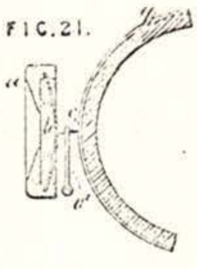


FIG. 22.

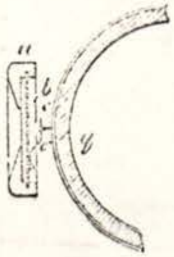


FIG. 23.

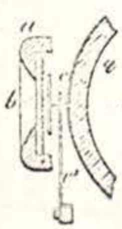


FIG. 24.

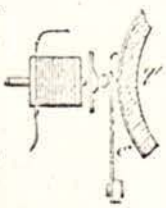


FIG. 25.

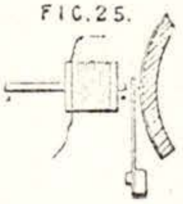


FIG. 26.

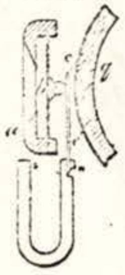


FIG. 27.

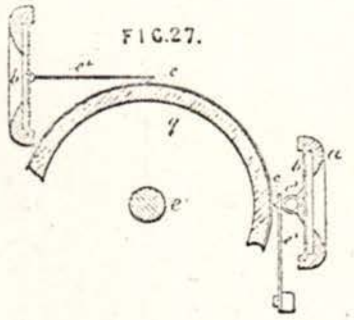


FIG. 28.

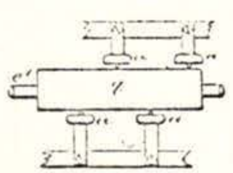
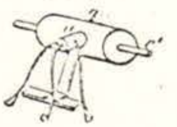


FIG. 29



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SHEET 3.

FIG. 30.

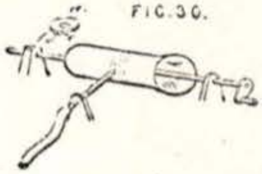


FIG. 31.

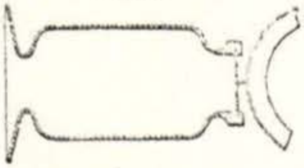


FIG. 32.

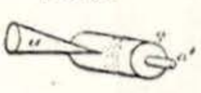


FIG. 33.

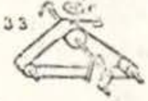


FIG. 34.

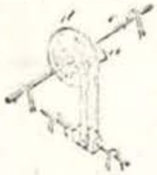


FIG. 35.

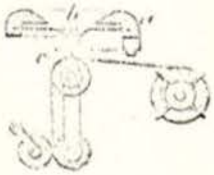


FIG. 36.

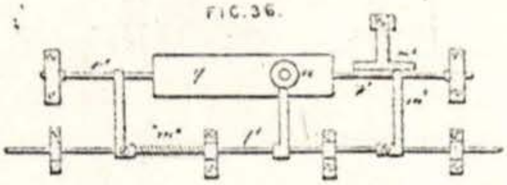


FIG. 37.

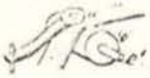


FIG. 38.

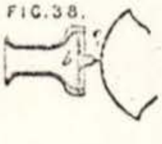


FIG. 39.

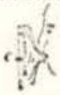


FIG. 40.

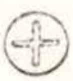


FIG. 41.

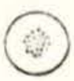
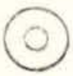


FIG. 42.



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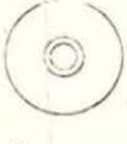


FIG. 44.

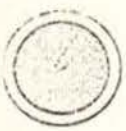


FIG. 45.

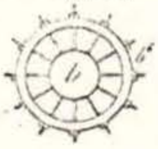
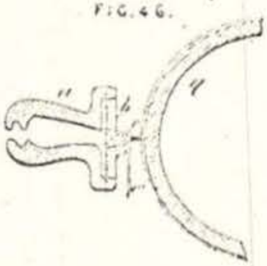


FIG. 46.



[illegible] WILL[illegible]
[illegible] May [illegible] 1878.

A.D. 1878. April 24. No. 1644.
EDISON'S SPECIFICATION.

FIG. 48.

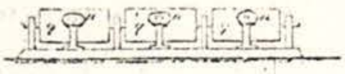


FIG. 49.

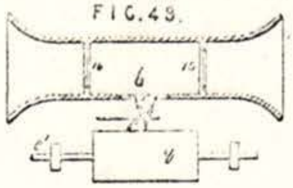


FIG. 47.

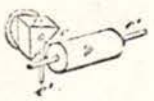


FIG. 50.

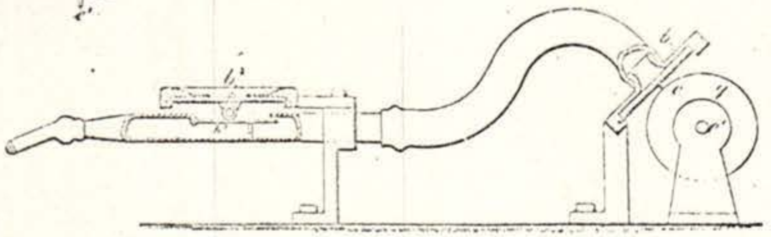
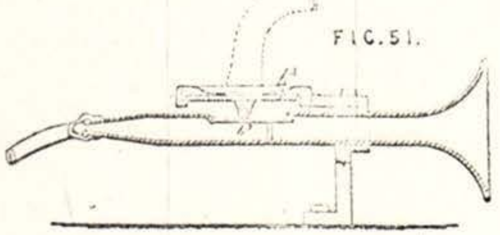


FIG. 51.



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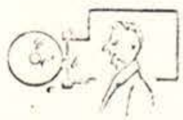


FIG. 54.

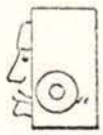
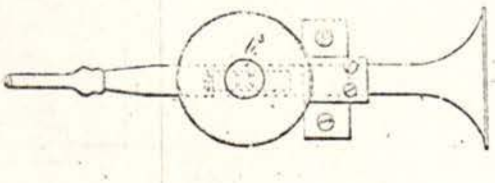


FIG. 52.



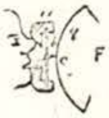


FIG. 55.

LONDON: Printed by George Edward Eyr
Printers to the Queen's most Ex

(4 SHEETS)
SHEET 4.

FIG. 56.

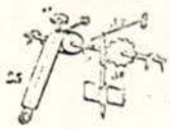


FIG. 57.

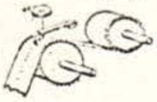


FIG. 58.

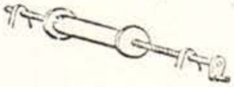


FIG. 59.

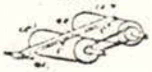


FIG. 60.

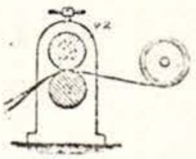


FIG. 61.

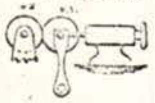


FIG. 62.

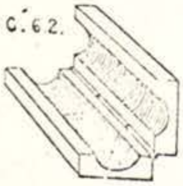


FIG. 63.

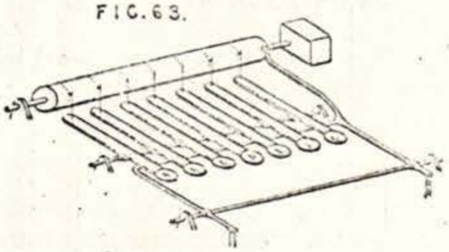


FIG. 64.

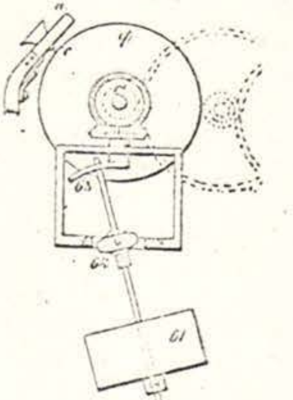


FIG. 65.

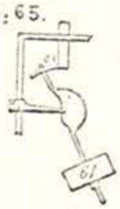


FIG. 67.

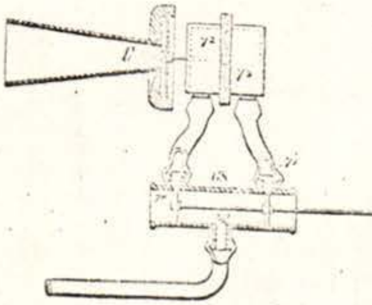
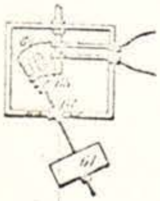


FIG. 66.



Eyre and William Spottiswoode
most Excellent Majesty. 1878.

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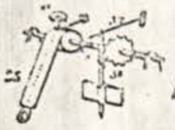
FIG 56.



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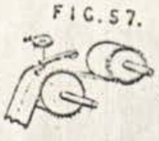


FIG. 58.

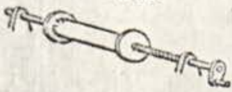


FIG. 59.

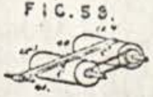
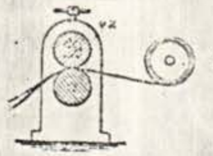


FIG. 60.



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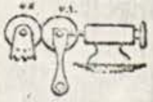

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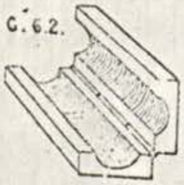

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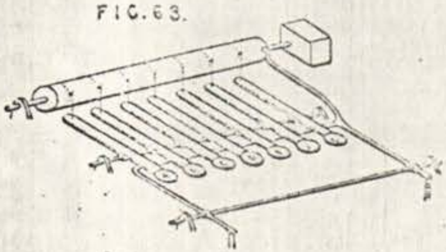

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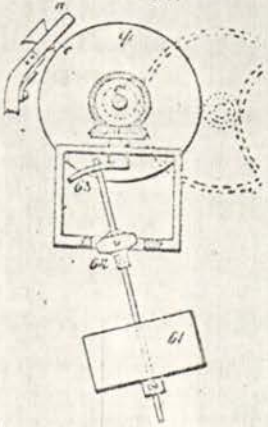


FIG. 65.

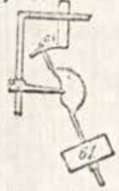


FIG. 67.

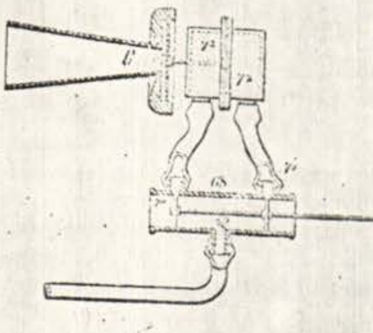
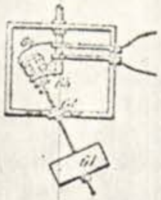


FIG. 66.



Eyre and William Spottiswoode.
most Excellent Majesty. 1878.

CIRCUIT COURT OF THE UNITED STATES,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY

vs. In Equity.

NATIONAL GRAMOPHONE COMPANY *et al.*

Affidavit of Philip Mauro.

District of Columbia, ss.:

PHILIP MAURO, being duly sworn, says:

I have already made an affidavit herein. I have since read the affidavit of Mr. Emile Berliner, verified November 22, 1898, to which is annexed copy of an opinion given by my firm to Mr. Berliner in September, 1891. This date does not appear on the opinion.

I am well acquainted with Mr. Berliner, and for many years have taken a personal and friendly interest in his work. At the time Mr. Berliner requested my firm for an opinion on his system—then in an undeveloped experimental stage—we had no professional relations with any company interested in the art of recording sounds. Mr. Berliner's experimental work has been confined to attempts to produce sound-records by the plan of Charles Cros, *i. e.*, by etching, and this was the subject exclusively studied in preparing said opinion. This clearly appears from the opinion itself which states at the outset:

> "At your request we have examined and considered the method and mechanism devised

> by you for the recording and reproduction of vocal and other sounds, *as set forth in United States patents Nos. 372,786, Nov. 8, 1887, and 382,790, May 15, 1888.*"

These patents appear in defendants' papers following page 33, and it will be seen that No. 382,790 relates wholly to methods of making records, and that while No. 372,786 shows a crude reproducing device, it is a very different mechanism from the self-adjusting reproducer which constitutes part of the modern gramophone.

This latter mechanism is shown and described in Berliner's patent No. 534,543, dated February 19, 1895, four years after the date of said opinion. This patent is also in defendant's papers.

Mr. Berliner is mistaken in saying that he submitted to me in 1891 for inspection a reproducing mechanism built substantially like that now in use. I remember seeing in his laboratory, about ten years ago, some experimental apparatus, but my attention was never directed to the reproducing mechanism, the recording method being the only distinctive feature of his work. From that time (*i. e.*, about 1888 or 1889), until about a year and a half ago, I never saw, and certainly never studied the construction of, a gramophone, though I frequently met Mr. Berliner and had friendly talks with him about his experiments, which for many years were occupied in attempting to produce saleable etched records. During all that time I had no idea that Mr. Berliner contemplated using, to reproduce from these records, the freely mounted or automatic reproducer, and certainly never formed or expressed the opinion that he could do so without infringing the patent in suit.

My attention was first directed to this feature of the gramophone about a year ago. Mr. Berliner called at my office for information about the ecophone case. He said he thought of suing the ecophone people as their machine was mechanically the same as his, and that it infringed one of his

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patents. I told him t
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In my study of the
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on Patent No. 427,279

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mechanism appear:

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patents. I told him that I did not see how he could have a patent for such a mechanism in view of the Bell & Tainter patent, and we had a general discussion of the subject, in course of which I pointed out to him the substantial identity of the ecophone mechanism with the graphophone, notwithstanding that the latter employed a feed-screw which the former dispensed with, and which in Mr. Berliner's mind constituted the patentable difference between his mechanism and the graphophone.

Shortly after this, to wit, in January, 1898, I bought a gramophone and studied its construction and operation. That it embraced the reproducer mechanism of the Bell & Tainter patent in suit, and infringed the claims involved in the ecophone case was palpable; but inasmuch as the validity of those claims was in controversy and about to be determined at final hearing, it was not deemed advisable to prosecute the makers of the gramophone until the ecophone case was disposed of.

In my study of the gramophone I had the files of Mr. Berliner's patents examined. In No. 534,543, above referred to, the following claim was rejected on Patent No. 427,279 of W. Suess and erased:

> "In a gramophone a reproducing diaphragm and stylus mounted upon a freely swinging arm having *universal movement* and *preponderating at one end to maintain the stylus automatically in engagement with the record groove*, whereby the latter guides the stylus, substantially as described."

In said patent to Werner Suess, Mr. Berliner's mechanical assistant (which patent issued to Berliner as assignee), the following statements touching the construction and operation of the reproducing mechanism appear:

> "The stylus engaging with its point the record grooves is controlled by the walls of the latter, and, as will be hereinafter more fully shown, I rely upon this control of the stylus

by the walls of the record groove for the movement of the stylus across the face of the disk, there being no positive feeding mechanism for thus moving the stylus" (p. 1, lines 61-69).

"The weight 35 is adjusted to nearly counterbalance the arm 12 and parts carried thereby, so that the stylus rests lightly, but with sufficient pressure on the tablet with its point in the record groove" (p. 2, lines 97-101).

"It will be understood that the counterweight may be adjusted to cause the stylus to bear with any desired degree of pressure on the tablet" (p. 2, lines 122-125).

Claim 2 of same patent to Suess is as follows:

> "2. In an apparatus for reproducing sounds from a record tablet, the combination with a reproducer mechanism consisting of a sound conveyor and a diaphragm and stylus mounted at one end thereof of a supporting frame for the said reproducer, *loosely pivoted to swing freely, both laterally and vertically*, and an adjustable counterweight on the said frame for determining *the pressure of the stylus on the record tablet*, substantially as described."

(Signed) PHILIP MAURO.

Subscribed and sworn to
before me this 1st day
of December, 1898.

(Signed) REEVE LEWIS,
[SEAL.] Notary Public,
District of Columbia.

UNITED ST

SOUTHERN

AMERICAN GRAPHO
PANY

VS.

NATIONAL GRAMOI
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Motion for prelimi
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LACOMBE, *Circuit J*

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held the claim f

(No Model.)

2 Sheets—Sheet 1.

W. SUESS.

GRAMOPHONE

No. 427,279.

Patented May 6, 1890.

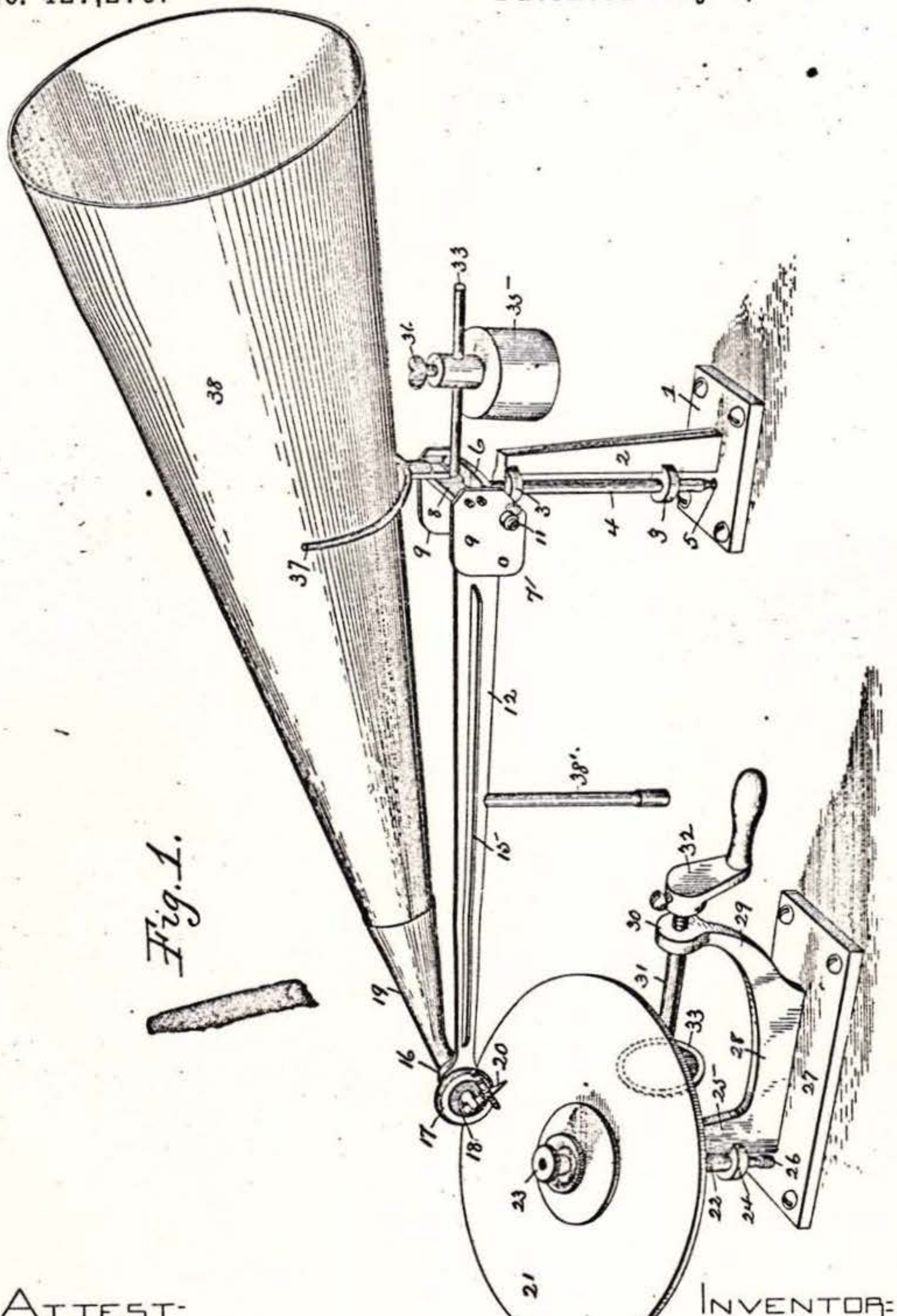

Fig. 1.

ATTEST-

Percy C. Bowen.
F. T. Chapman

INVENTOR:

Werner Suess,
By Joseph Lyons.
his Attorney.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. SUESS.

GRAMOPHONE.

No. 427,279. Patented May 6, 1890.

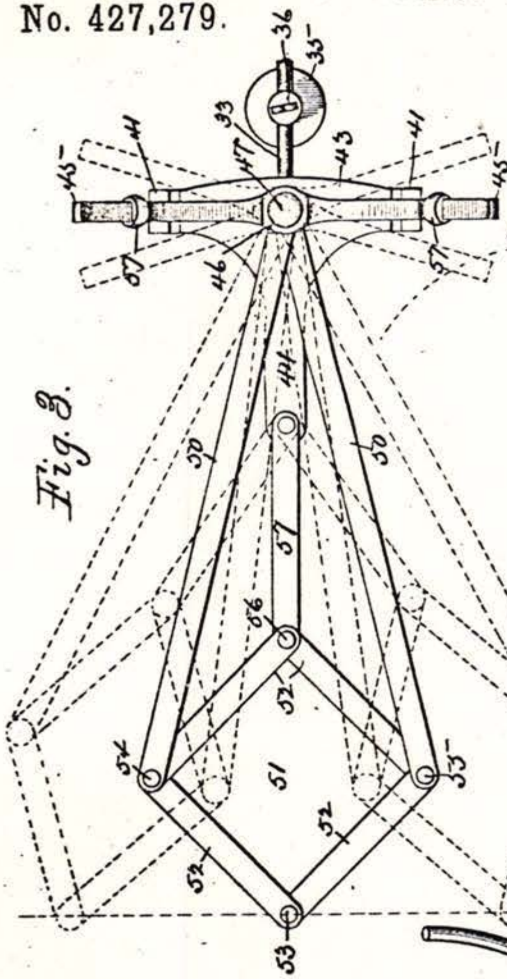
Fig. 3.

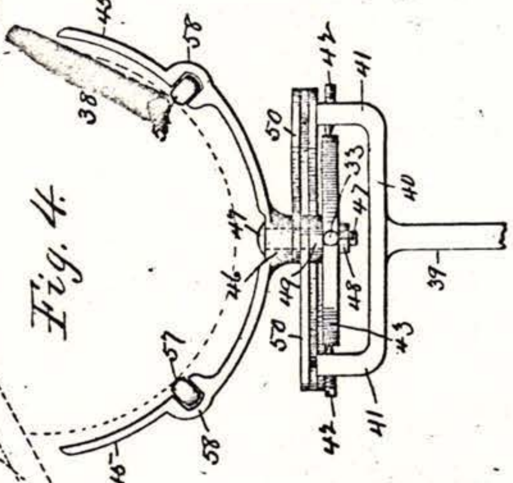
Fig. 4.

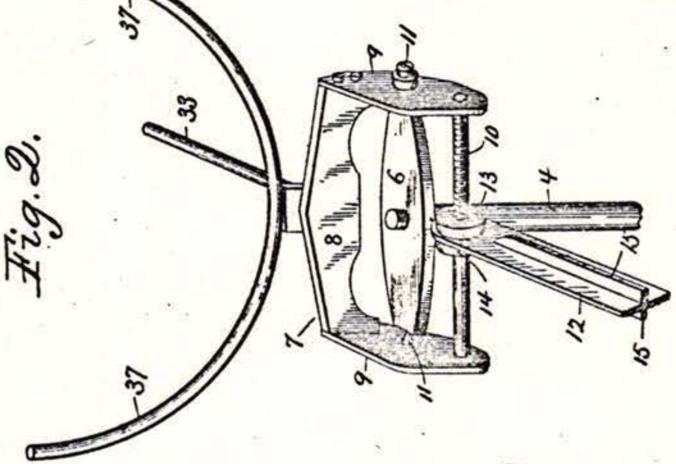
Fig. 2.

Witnesses

Percy C. Bowen.
F. T. Chapman

Inventor.

Werner Suess.

By his Attorney
Joseph Lyons.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WERNER SUESS, OF WASHINGTON, DISTRICT OF COLUMBIA, ASSIGNOR TO
EMILE BERLINER, OF SAME PLACE.

GRAMOPHONE.

SPECIFICATION forming part of Letters Patent No. 427,279, dated May 6, 1890.

Application filed August 6, 1889. Serial No. 319,866. (No model.)

To all whom it may concern:

Be it known that I, WERNER SUESS, a citizen of the United States, and a resident of Washington, in the District of Columbia, have invented certain new and useful Improvements in Gramophones, of which the following is a specification.

My invention has reference to improvements in the reproducing apparatus adapted for use in the method of recording and reproducing sounds set forth in Letters Patents No. 372,786, of November 8, 1887, and No. 382,790, of May 15, 1888, both granted to Emile Berliner. The whole apparatus used for the practice of the said method has been called the "gramophone," and in this class of sound recording and reproducing apparatus the record is ordinarily produced on the face of a rotating disk as a volute band consisting of a sinuous or undulating groove of even depth. In the production of this record a recording-stylus is made to travel over the face of the rotating disk from the outer circumference toward the center in a straight radial path. The reproduction of the recorded sounds is effected by giving to a reproducing-stylus vibratory movement by and in accordance with the sinuosities of the record-groove, and, these vibratory movements being transmitted to a diaphragm, vibrations of the latter give rise to sounds which are copies of the sounds originally uttered against the recording apparatus.

With the view of intensifying the sound emitted by the reproducer, and more especially of directing the same to the listener or listeners, I use a funnel-shaped tube, on the contracted end of which the reproducing stylus and diaphragm are mounted, while the open flaring end of the tube is directed toward the listener or listeners. This flaring sound-conveyer, thus becoming an integral part of the reproducer, must have all the mass movements of the stylus and diaphragm, and being of considerable weight it must be so supported and balanced that the recording-stylus will bear with light but sufficient pressure upon the record-tablet. The best results are obtained if the reproducing-stylus is made to travel in a straight radial line across the face of the record-tablet, substantially in the manner in which the recording-stylus has traveled in producing the record. The main features of my present invention therefore have reference to the means for supporting and counterbalancing the sound-conveying tube with its attached diaphragm and reproducing-stylus and for making the path of the stylus across the face of the record-disk as nearly as practicable a straight radial line. The stylus engaging with its point the record-groove is controlled by the walls of the latter, and, as will be hereinafter more fully shown, I rely upon this control of the stylus by the walls of the record-groove for the movement of the stylus across the face of the disk, there being no positive feeding mechanism for thus moving the stylus. All this will more fully appear from the following detailed description, in which reference is made to the accompanying drawings, which form a part of this specification, and in which I have shown, in—

A

Figure 1, a perspective view of one form of reproducer, shown in the supporting-frame with a sound-conveying tube, with the diaphragm and stylus in operative relation to the record-disk. Fig. 2 is a perspective view of the pivotal bearing of the frame with parts removed and broken away. Fig. 3 is a plan view of another form of supporting-frame for the reproducer, by which the stylus is caused to travel in a straight line across the record-tablet. Fig. 4 is an end view of the same with the counter-weight removed.

Like numerals of reference indicate like parts all throughout the drawings.

Referring now to Fig. 1, there is shown a base-plate 1, which may be secured by screws or otherwise to any suitable support—such, for instance, as a table. Erected on this base-plate is a standard 2, on one edge of which are laterally-projecting eyes 3, forming guides in which turns a vertical shaft or pivot 4. This shaft is stepped at the lower end in a bearing 5 in the base-plate, and at the upper end has secured to or formed on it a head 6, which, as shown more clearly in Fig. 2, consists of a flat plate, to the center of which the shaft 4 is attached. This head 6 serves as a support for a frame 7, consisting of an end piece 8, two parallel side pieces 9, secured at one end to the end piece by screws, as shown, or otherwise, and a rod 10, joining the other ends of the side pieces 9. Mounted in the side pieces 9 are pointed screws 11, projecting through nuts therein and entering oppositely-arranged seats (not shown) in the ends of the head 6, and forming a pivotal bearing for the frame 7, around which it may turn in a vertical plane at right angles to the axis of the shaft 4. It will now be understood that the frame 7 may be moved in any direction, the shaft 4 and pivot-screws 11 constituting a universal joint for the same. The rod 10 carries one end of an arm 12, secured rigidly thereon by a jam-nut 13, which clamps the said arm firmly against a flange 14 on the rod, which latter is screw-threaded, as shown, for the reception of the nut 13. The arm 12 is stiffened by longitudinal side ribs 15 and terminates at the free end in a head 16, on one side of which is secured a diaphragm-holder 17, carrying a diaphragm 18, and on the other side of the head there is secured a flaring socket 19, communicating at its reduced end with a chamber (not shown) at the rear of the diaphragm.

Attached to the diaphragm is a stylus 20, mounted for lateral vibration, and, together with the said diaphragm, forming a sound-reproducer. The construction of the stylus and the mounting therefor form no part of the present invention, and are therefore not specifically described herein. The point of the stylus rests normally in the record-groove produced on the face of a disk-tablet 21, which is mounted for rotation upon a disk carried by a vertical shaft 22, similar to the shaft 4, before described. As shown in Fig. 1, the shaft 22 has at its upper end a thumb-nut 23, by means of which the tablet is clamped thereon, and the said shaft is passed through eyes 24 (one only being shown) on a standard 25 and stepped in a bearing 26 in a base-plate 27, on which the standard is erected. The lower end of the standard is extended laterally on the plate 27, as shown at 28, and terminates in an upturned end 29, carrying at its upper end and below the level of the tablet a bearing 30 for a horizontal shaft 31, which latter is provided with a crank 32 at the outer end and a friction-wheel 33 at the inner end, which wheel engages the under side of the tablet-supporting disk, which is not visible in the drawings. It will now be understood that when the shaft 31 is rotated by means of the crank 32 the friction-wheel 33, engaging the tablet-support, will cause the latter to rotate and carry successive portions of the record under the stylus to reproduce the sounds in a manner described in the aforesaid Letters Patent.

The mechanism for supporting and rotating the tablet may be of any suitable construction and entirely different from that shown, such construction being by no means an essential feature of my invention.

Secured to the end piece 8 of the frame 7 is a rod or arm 33′, extending in a direction opposite to that of the arm 12, and carries a weight or block 35. This weight may be adjusted upon rod 33′ and clamped in any desired position on a thumb-screw 36.

Attached to a short stem erected on the end piece 8 and over the shaft 4 is a semicircular bracket 37, on which rests the funnel-shaped sound-conveyer 38, the smaller end of which enters the socket 19. It will be readily understood that the sound-conveyer supported in the manner described, together with the diaphragm and stylus carried in the mounting attached to the arm 12, may be moved laterally around the axis of the pivot-shaft 4 and vertically around the axis of the frame 7. By reason of these two movements the stylus may be made to approach toward or recede from the axis of the rotating tablet, and in this manner traverse every portion of the surface of the said tablet, or it may be swung aside and entirely removed therefrom.

The operation of an apparatus so constructed is as follows: The tablet 21, containing a sound-record in the form of a convolute, sinuous, or wavy groove produced in the manner set forth in my aforesaid Letters Patents, is mounted on the supporting-disk carried by the shaft or spindle 22. The weight 35 is adjusted to nearly counterbalance the arm 12 and parts carried thereby, so that the stylus rests lightly, but with sufficient pressure, on the tablet with its point in the record-groove. B The tablet is now rotated and the sinuous groove thereon vibrates the stylus, which in turn vibrates the diaphragm in accordance therewith, and thus produces sound-waves, which latter are directed toward the listener by the sound-conveyer 38. As the rotation of the tablet is continued the convolutions of the record-groove will cause the stylus to be slowly drawn across the tablet, turning the entire support of the reproducing apparatus on its pivot-bearing, the said stylus moving along a slightly-curved path over the said tablet. When placing a tablet in position, or on removing it therefrom, it is necessary to move the reproducer out of operative relation thereto, and for this purpose the supporting-frame is swung on the horizontal and vertical pivots to some position away from the tablet, when it may be lowered until a leg 38′, which depends from the arm 12, rests upon the table on which the apparatus is secured. It will be understood that the counter-weight may be adjusted to cause the stylus to bear with any desired degree of pressure on the tablet. b

Referring now more particularly to Figs. 3 and 4, there is shown a standard or post 39, which is fixed to a table or other support and terminates at the upper end in a yoke 40, having two upturned parallel ends 41, each carrying an inwardly-projecting pointed screw 42, extending through a suitable nut formed therein. The pointed ends of these screws enter suitable seats on opposite sides of a

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plate 43 and constitute a horizontal pivotal bearing on which the said plate may be rocked. The plate 43 has an arm 44 formed on it and extending centrally from one side at right angles to its axis, and it also has another arm 33′, similar to that shown in Figs. 1 and 2, extending in a direction opposite to the arm 44, being on the other side of the axis of the plate. The arm 33′ carries a sliding weight 35, similar in construction to that before described, and in a like manner serving as a counter-weight. Above the center of the plate 43 there is a semicircular bracket consisting of two curved branching arms 45, rising from a block 46. Through this block there is a perforation for a pivot-bolt 47, which extends downwardly through the plate 43 and there receives a nut 48, by means of which the bolt is secured to the said plate, and the head of the bolt engages the upper face of the said block 46. This bolt 47 also passes through a washer 49, resting directly on the upper surface of the plate 43, and through eyes formed in the ends of links 50, the said ends being interposed between the lower end of the block 46 and the washer 49. Thus it will be seen that the bolt forms a vertical pivot around which the bracket 45 46 and the links 50 may move, and also secures them to the said plate. The outer ends of the links 50 are pivoted to opposing corners of an articulated frame 51, composed of links 52, of equal length, connected together at the ends by pivot-pins 53, 54, 55, and 56, respectively, the pins 54 and 55 also connecting the links 50 to the frame at the points before mentioned. The pin 56 also pivotally connects one end of a link 57 to the corresponding corner of the frame 51, the other end of the said link being pivoted to the outer end of the arm 44.

The frame 51, together with the links 50 and 57, constitutes a well-known mechanical movement by which a curvilinear movement is converted into a rectilinear movement, provided the various links have the proper relative lengths, which is supposed to be the case in this instance, and therefore no detailed description of the operation thereof is deemed necessary.

In the apparatus shown in Figs. 3 and 4 the arm 12 is replaced by the link movement or system, and in this case the stylus and diaphragm will be mounted on the outer or free end of the said link system—namely, at 53—and the sound-conveyer 38 (indicated by dotted lines in Fig. 4) will rest on friction-rollers 57, mounted in bearings formed in cut-away or recessed portions 58 of the bracket-arms 45. In the operation of this apparatus the counter-weight 35 is adjusted in the manner before described and the entire reproducer mechanism is moved to a position in which the stylus rests on the tablet at the beginning of the record to be produced. Such position is indicated in Fig. 3 by the upper series of dotted lines, from which it will be seen that the frame 51 is of greater length than breadth. As the record-tablet is rotated the volute record-groove acting on the stylus slowly draws it across the face of the tablet, as before explained, and turns the entire reproducing apparatus on its vertical axis or pivot 47. As the apparatus approaches the position coinciding with the vertical plane of the arm 44 of the plate 43 the link 57, moving through an arc of shorter radius than that of the links 50, tends to force the frame 51 outward, which tendency is resisted by the said links 50, and the consequent action of these two opposing forces is to shorten the length and increase the breadth of the said frame 51 until it assumes the square form shown in full lines, Fig. 3. As the movement of the stylus is continued beyond the central plane of the arm 44 the frame 51 will be again lengthened, as indicated by the lower series of dotted lines. It will be understood that the length of the frame 51 decreases as the latter approaches a central position and increases as it recedes therefrom, and in accordance with this change of shape of the said frame its outer end (and the stylus thereon) will be carried to a constantly-increasing distance from the pivot or axis of the apparatus, and the resultant of this constant longitudinal movement of the outer end of the frame while the apparatus moves in an arc around its pivot is to move the said end in a straight line. When the reproducer-stylus is moved over the record-tablet in the manner stated, its path will coincide with the radius of such tablet, and the point of the said reproducer-stylus will be at all times in the same relation to the record-grooves as was the recorder-stylus in producing such record. In this operation the sound-conveyer must participate in the movement of the stylus toward and from the pivot 47, and it will therefore slide upon the arms 45 of the supporting-bracket, and with a view of reducing the friction the rollers 57 are provided.

Having now fully described my invention, I claim and desire to secure by Letters Patent—

1. In an apparatus for reproducing sounds from a record-tablet, the combination, with a reproducer mechanism consisting of a sound-conveying tube and a diaphragm and stylus mounted at one end of the tube, of a freely-swinging supporting-frame for the said reproducer mechanism and a weight adjustable on the said frame to counterbalance the reproducer mechanism, substantially as described.

2. In an apparatus for reproducing sounds from a record-tablet, the combination, with a reproducer mechanism consisting of a sound-conveyer and a diaphragm and stylus mounted at one end thereof, of a supporting-frame for the said reproducer, loosely pivoted to swing freely both laterally and vertically, and

an adjustable counter-weight on the said frame for determining the pressure of the stylus on the record-tablet, substantially as described.

3. In an apparatus for reproducing sounds from a record-tablet, the combination, with a reproducer mechanism consisting of a sound-conveyer and a diaphragm and stylus at one end of the said conveyer, of a counterweighted pivoted frame for supporting the reproducer mechanism and provided with a system of laterally-movable pivoted links connected at one end to the said reproducer mechanism and at the other to a portion of the supporting-frame fixed against lateral movement, substantially as described.

4. In an apparatus for reproducing sounds from a record-tablet, the combination, with a reproducer mechanism consisting of a sound-conveyer and a diaphragm and stylus at one end of the said conveyer, of a system of links supporting the stylus end of the reproducer and proportioned and arranged, as described, for moving the stylus in a straight path across the record-surface, substantially as described.

5. In an apparatus for reproducing sounds from a record-tablet, the combination, with a reproducer mechanism consisting of a sound-conveyer and a diaphragm and stylus at one end of the said conveyer, of a system of links supporting the stylus end of the reproducer and constructed, as described, for moving the stylus in a straight path across the record-surface, and a pivoted bracket on which the sound-conveyer rests, provided with anti-friction rollers on which the said conveyer travels longitudinally to participate in the movement of the stylus end of the reproducer, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WERNER SUESS.

Witnesses:
F. T. CHAPMAN,
J. B. MACAULEY.

(Copy.)

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY

VS.

NATIONAL GRAMOPHONE COMPANY and another.

Motion for preliminary injunction on U. S. patent to Bell & Tainter for Improvement in Recording and Reproducing Speech, &c., No. 341,-214, May 4, 1886.

LACOMBE, *Circuit Judge:*

Although the notice of motion embraces claims 19 to 23, both inclusive, complainant has addressed its argument solely to claim 21—the others may be considered as withdrawn from this application. It is difficult to see upon what theory this Court can assume that Judge Shipman in the case of the same plaintiff *vs.* Leeds (87 Fed. Rep., 873), held the twenty-first claim not to be valid in view of the fact that the decree in that case expressly declares that the patent is valid so far as that claim is concerned. Nor is there anything in the opinion in the Leeds case which would require this Court to read additional elements into claim 21, thereby making it identical with one or more of the other claims, which were also sustained. It seems reasonably clear that this Court did not entirely concur with Judge Grosscup. Certainly it held the claim for the loosely mounted reproducer, or gravity reproducer, or floating reproducer to be valid; and in disposing of the present motion this must be taken as adjudicated—no new evidence of any weight being introduced.

The claim reads as follows:

"21. The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described."

Defendants seek to escape infringement upon the theory that the sinuosities in their record which preserve and reproduce the sound waves are found in the walls of the groove instead of in the bottom; wherefore, as they contend, the reproducer is not held with a yielding pressure against the record, but is moved positively by the side walls. A careful perusal of the patent, however, indicates that the word "record" is not used to indicate solely that particular part of the recording groove whereon the sound waves are recorded by elevations and depressions. Thus referring to the operation of the reproducer the specification says: "No special care is necessary to insure its adjustment, for if the reproducer be allowed to rest against the the record with the style upon the engraved line the style will of itself gravitate to the bottom of the groove." And again: "Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the record." The earlier art shows a reproducer held rigidly; the "floating reproducer" was adapted to put itself in place and keep itself in place despite the various disarrangements of parts to which machines of this class are liable. And in defendants' machine this same automatic action is secured in the same way. Resting always on the bottom of the groove the reproducer is always in that part of the groove or record held there by yielding pressure—where it can be acted upon by the irregular surface which preserves the sound waves, and it would seem to make little difference whether that surface was located at the bottom or at the side of the groove; especially in view of the language of the specification: "The reproducing-style mounted as just explained, is specially adapted for use in connection with a record in the form of a groove with sloping walls and this combination is specially claimed; but it may also be usefully employed in connection with other forms of record."

There seems to be no special equity in the circumstance that defendants have not heretofore been disturbed by suit; complainant has evidently been diligent in bringing suits against earlier infringers and was under no obligation to sue every one at the same time.

Upon formally withdrawing the motion as to the other claims complainant may take an order in the usual form as to No. 21. After the order is entered, however, its operation will be suspended until January 25, 1899, in order to give defendants an opportunity to prosecute and argue an appeal if they be so advised.

UNITED STATES CIRCUIT COURT,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.	In Equity. No. 7063.

To CHARLES E. MITCHELL, Esq.,
Of Counsel for Defendants.

Take notice that the motion for preliminary injunction in this case is withdrawn so far as it relates to claims 19, 20, 22 and 23 of Patent No. 341,214 in suit.

Yours, &c.,

RICH. N. DYER,
Of Counsel for Complainant

New York, December 13, 1898.

Service of a copy of the above notice acknowledged this 13th day of December, 1898.

C. E. MITCHELL,
Of Counsel for Defendants

(Endorsed)—United States Circuit Court, Southern District of New York.—In Equity, No. 7063. American Graphophone Company vs. National Gramophone Company and Frank Seaman. Notice of Withdrawal of Claims 19, 20, 22 and 23.—Richard N. Dyer, Complt.'s Solr., 31 Nassau St., New York City, N. Y.—U. S. Circuit Court.—Filed Dec. , 1898.—John A. Shields, Clerk.

At a Stated Term of the United States
Circuit Court for the Southern District
of New York, held in the Rooms of the
Court, in the Borough of Manhattan,
in said District, on the day
of December, 1898.

Present—Hon. E. HENRY LACOMBE,
Circuit Judge.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.

In Equity,
No. 7063.

This cause coming on to be heard on motion for preliminary injunction on bill of complaint and affidavits on behalf of complainant and on affidavits on behalf of defendants, and Philip Mauro, Esq., and Richard N. Dyer, Esq., for the complainant, and Charles E. Mitchell, Esq., for the defendants' having been heard, and the motion for temporary injunction having been withdrawn, so far as relates to claims 19, 20, 22 and 23 of Patent No. 341,214 in suit; now therefore, it is

Ordered, that a preliminary injunction issue against the defendants in accordance with the prayer of the bill of complaint on claim 21 of Patent No. 341,214 in suit.

E. HENRY LACOMBE,
U. S. Circuit Judge.

(Endorsed)—U. S. Circuit Court.—Filed Dec. ,
1898.—John A. Shields, Clerk.

CIRCUIT COURT OF THE UNITED STATES.

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.	In Equity. No. 7063.

A motion having been made herein for a suspension of the injunction this day granted in the above entitled case pending an appeal from said order to the Circuit Court of Appeals, and counsel for the respective parties having been duly heard, it is

Ordered, that said injunction be and the same hereby is suspended until January 25, 1899, in order to give defendants an opportunity to prosecute and argue said appeal.

E. HENRY LACOMBE,
U. S. Circuit Judge.

(Endorsed)—U. S. Circuit Court.—Filed Dec. 1898.—John A. Shields, Clerk.

CIRCUIT COURT OF THE UNITED STATES,

SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY vs. NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.	In Equity. No. 7067.

Assignment of Errors.

And now come the defendants-appellants into Court by their counsel and say, that in the record and proceedings therein, including the order entered on the 15th day of December, 1898, granting a preliminary injunction, there is manifest error in this, to wit:

1. The Court erred in granting a preliminary injunction.

2. The Court erred in that on motion for preliminary injunction it construed claim 21 in view of its own understanding of the specification of the patent instead of construing it in accordance with the prior adjudications.

3. The Court erred in giving claim 21 a construction broader than any which had been given to that claim in the adjudications sustaining the patent.

4. The Court erred in considering and deciding vital matters of differences of construction and mode of operation between complainant's patent and defendants' machine, on *ex parte* affidavits in a motion for a preliminary injunction, which matters

were not involved in any prior case and have not been adjudicated.

5. The Court erred in not giving effect to the history of the invention of the patent in suit, being the Bell & Tainter graphophone, an improvement on the Edison phonograph, and the history of the invention of the defendants' machine, being the Berliner gramophone, an improvement on the sound recorder and reproducer of the Frenchman Cros, which histories of the two inventions create such a presumption that there is no interference, contact or overlap between the work of Bell & Tainter and of Berliner as to entitle the defendants to a full and final hearing.

6. The Court erred in disregarding the special equities of defendants as set forth in defendants' affidavits.

7. The Court erred in holding that the complainant had not lost its right to a preliminary injunction by reason of its laches in failing to bring suit against or notifying the defendants that defendants' operations were considered an infringement of complainant's patent, which failure to sue or notify defendants extended over a period of four years during which time defendants' business was growing up and which failure to sue or notify the defendants was in spite of the fact shown by defendants' affidavits that complainant knew that the questions necessary to be decided to hold defendants as infringers of complainant's patent were not involved in the suits which complainant was prosecuting.

8. The Court erred in construing the word "record" as used in claim 21 to mean the groove upon which the record is formed, overlooking the fact that the specification and claims of the patent are each careful to distinguish between these terms, "groove" and "record," and the facts which they represent.

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9. The Court erred in assuming that defendants could not show by a hearing upon full proofs that claim 21 is a void and unpatentable claim, when construed so broadly as to cover a stylus pressing upon the flat floor of a groove and taking its vibrations positively from the side walls thereof.

10. The Court erred in holding with reference to claim 21 that "it would seem to make little difference whether the irregular or record surface was located at the bottom or at the side of the groove."

11. The Court erred in giving claim 21 a construction which makes its substantial subject matter anticipated by Edison's English Patent A. D. 1878, No. 1644, and also by Edison's United States Patent No. 200,521 of February 19, 1878.

Wherefore, and for divers other errors in the said record appearing, the defendants-appellants pray that the interlocutory order appealed from may be reversed and annulled, and that an order be directed to be entered denying the preliminary injunction asked for by the bill of complaint and vacating and setting aside the preliminary injunction granted herein.

C. E. Mitchell,
Solicitor and of Counsel for Frank Seaman.
Waldo G. Morse,
Solicitor for the National Gramophone Co.

(Endorsed.)—U. S. Circuit Court, So. District of New York.--American Graphophone Co. *vs.* National Gramophone Co. and Frank Seaman. —Assignment of Errors.—U. S. Circuit Court. --Filed Dec. 15, 1898.—John A. Shields, Clerk.

CIRCUIT COURT OF THE UNITED STATES OF AMERICA

FOR THE SOUTHERN DISTRICT OF NEW YORK, IN THE SECOND CIRCUIT.

AMERICAN GRAPHOPONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.

Bond for Damages and Costs.

KNOW ALL MEN BY THESE PRESENTS, that the Lawyers' Surety Company of New York, having an office and principal place of business at Nos. 32, 34 and 36 Liberty street, in the City of New York, County and State of New York, is held and firmly bound unto the above named American Graphophone Company, in the sum of five hundred (500) dollars, to be paid to the said American Graphophone Company, for the payment of which well and truly to be made, it binds itself, its successors and assigns, jointly and severally, firmly by these presents. Sealed with its seal, and dated the 15th day of December, in the year of our Lord one thousand eight hundred and ninety-eight.

Whereas, the above named National Gramophone Company and Frank Seaman have prosecuted an appeal to the United States Circuit Court of Appeals for the Second Circuit, to reverse the order rendered in the above entitled suit, by the Judge of the Circuit Court of the United States for the Southern District of New York,

Now, therefore, the condition of this obligation is such, that if the above named National Gramophone Company and Frank Seaman shall prosecute their appeal to effect, and answer all damages and costs if they fail to make their plea good, then this obligation shall be void, otherwise the same shall be and remain in full force and virtue.

THE LAWYERS' SURETY COMPANY
OF NEW YORK,
By THOMAS HUNT,
[SEAL.] 2d Vice-President.
Attest: JOEL RATHBONE,
Secretary.

State and County of New York, ss.:

On this 15th day of December, 1898, before me personally appeared Thomas Hunt, Second Vice-President of The Lawyers' Surety Company of New York, with whom I am personally acquainted, who, being by me duly sworn, said: That he resides in the City of New York; that he is the Second Vice-President of The Lawyers' Surety Company of New York, the corporation described in and which executed the above instrument; That he knows the corporate seal of said Company; that the seal affixed to the foregoing instrument is such corporate seal; that it was affixed by order of the Board of Directors of said Company, and that he signed said instrument as Second Vice-President of said Company by like authority; and that the liabilities of said Company do not exceed its assets, as ascertained in the manner provided in Section 3, Chapter 720 of the New York Section Laws of 1893. And the said Thomas Hunt further said that he is acquainted with Joel Rathbone, and knows him to be the Secretary of said Company; that the signature of the said Joel Rathbone subscribed to the said instrument is in the genuine handwriting of the said Joel Rathbone, and was thereto subscribed by the like order of the said Board of Directors and in the presence of him, the said Thomas Hunt, Second Vice-President.

H. G. HINTON,
[SEAL.] Notary Public,
Kings Co., N. Y.
Certificate filed in N. Y. Co.

At a stated meeting of the Board of Directors of The Lawyers' Surety Company of New York, held at the office of the Company, Nos. 32, 34 and 36 Liberty street, in said city, on the 21st day of April, 1897, on motion, it was unanimously

" Resolved, that the President, the Vice Presi
" dent, the Acting President or the Second Vice-
" President be, and either of them is hereby
" authorized and empowered to sign, execute and
" deliver any and all bonds or undertakings for or on
" behalf of the Company, and to attach thereto the
" seal of the corporation, the same to be attested by
" the Secretary or the Acting Secretary."

County of New York, ss.:

I, Joel Rathbone, Secretary of The Lawyers' Surety Company of New York, have compared the foregoing resolution with the original thereof, as recorded in the minute book of said Company, and do certify that the same is a true and correct transcript therefrom, and of the whole of said original resolution.

Given under my hand and seal of the Company, at the City of New York, this 15th day of December, 1898.

Joel Rathbone,
[seal.] Secretary.

(Endorsed)—U. S. Circuit Court, Southern District of New York.—American Graphophone Company *vs.* National Gramophone Company & ano.—Copy.—Bond for damages and costs on appeal.—(Orig. Endorsed): U. S. Circuit Court. —Filed Dec. 15, 1898.—John A. Shields, Clerk.

CIRCUIT COURT OF THE UNITED STATES.

SOUTHERN DISTRICT OF NEW YORK.

IN EQUITY.

AMERICAN GRAPHOPHONE COMPANY
vs.
NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN.
No. 7063.

Petition for Appeal.

The above named defendants conceiving themselves aggrieved by the interlocutory order entered on the 15th day of December, 1898, in the above entitled cause, granting a preliminary injunction, do hereby appeal therefrom to the United States Circuit Court of Appeals for the Second Circuit, and they pray that their appeal may be allowed and a citation granted, directed to the above named complainant and commanding it to appear before the United States Circuit Court of Appeals for the Second Circuit, to do and receive what may pertain to justice to be done in the premises, and that a transcript of the record, proceedings and evidence in said cause, duly authenticated, may be transmitted to the United States Circuit Court of Appeals for the Second Circuit.

WALDO G. MORSE,
Solicitor for National Gramophone Co., Defendant.

MITCHELL, BARTLETT & BROWNELL,
C. E. MITCHELL,
Solicitors for Frank Seaman, Defendant.

The foregoing appeal is hereby allowed.

Dated New York, December 15, 1898.

E. HENRY LACOMBE,
U. S. Circuit Judge.

(Endorsed)—United States Circuit Court, So. District of New York.—American Graphophone Company *vs.* National Gramophone Company and Frank Seaman.—Petition for Appeal.—Mitchell. Bartlett & Brownell, Solicitors for Defendant, Frank Seaman, 41 Park Row, New York.—(Orig. Endorsed): U. S. Circuit Court. Filed, Dec. 15, 1898.—John A. Shields, Clerk.

Citation on Appeal.

UNITED STATES OF AMERICA, ss.:

THE PRESIDENT OF THE UNITED STATES,

THE AMERICAN GRAPHOPHONE COMPANY, a corporation established under the laws of the State of West Virginia, GREETING:

You are hereby cited and admonished to be and appear in the United States Circuit Court of Appeals for the Second Circuit, in the City of New York, Borough of Manhattan, on the 9th day of January next, pursuant to an appeal duly taken from the interlocutory order of the Circuit Court of the United States for the Southern District of New York, granting a preliminary injunction in a cause wherein you are the appellee, and the National Gramophone Company, a corporation established under the laws of the State of New York, and Frank Seaman, are appellants, to show cause, if any there be, why the said interlocutory order entered against said appellants, should not be corrected and why speedy justice should not be done to the parties in that behalf.

Witness, The Honorable E. Henry Lacombe, Judge of the Circuit Court of the United States for the Southern District of New York, this 15th day of December, in the year of our Lord one thousand eight hundred and ninety-eight.

E. Henry Lacombe,
U. S. Circuit Judge.

Due service of the within citation is hereby acknowledged, this 16th day of December, 1898.

Rich. N. Dyer,
Solicitor for Complainant.

(Endorsed)—United States Circuit Court, So. District of New York.—American Graphophone Company *vs.* National Gramophone Company and Frank Seaman.—Citation.—Mitchell, Bartlett & Brownell, Solicitors for Defendant, Frank Seaman, 41 Park Row, New York.—(Orig. Endorsed): U. S. Circuit Court.—Filed Dec. 16, 1898.—John A. Shields, Clerk.

United States of America,
Southern District of New York, } ss.:

I, John A. Shields, Clerk of the Circuit Court of the United States of America, for the Southern District of New York, in the Second Circuit, do hereby certify that the foregoing pages, numbered from one (1) to two hundred and thirty-two (232) inclusive, contain a true and complete transcript of the record and proceedings had in said Court in the case of American Graphophone Company, complainant and appellee, against National Gramophone Company and Frank Seaman, defendants and appellants, as the same remain of record and on file in my office.

In testimony whereof, I have caused the seal of the said Court to be hereunto affixed, at the City of New York, in the Southern District of New York, in the Second Circuit, this seventeenth day of December in the year of our Lord one thousand eight hundred and ninety-eight, and of the Independence of the said United States, the one hundred and twenty-third.

JOHN A. SHIELDS,
[SEAL.] Clerk.

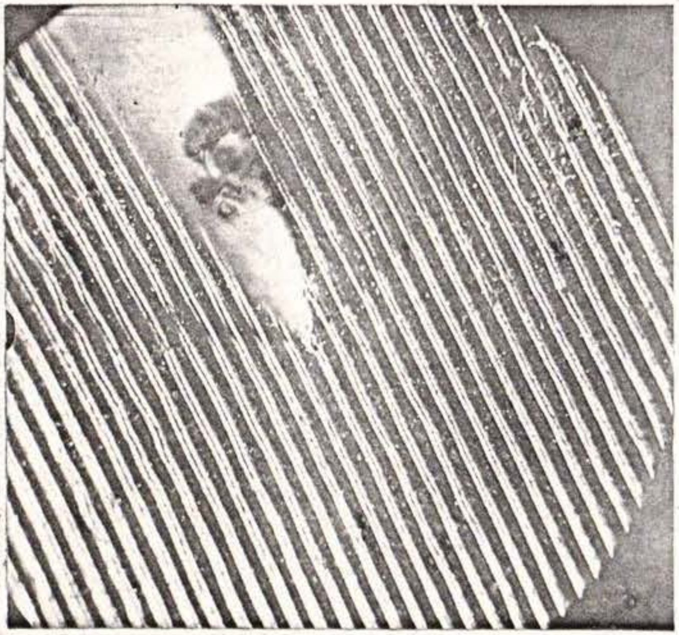
(Stamp.)

U.S.Circuit Court
Southern District of N.Y.

American Graphophone Company
v.
National Gramophone Co. and
Frank Seaman.

COMPLAINANT'S EXHIBIT MICRO PHOTO
DEFENDANTS' STYLE AND RECORD.

Notary Public,
District of Columbia



Complainants Ex -
Microphoto -
Defts Style + Record -

U.S.Circuit Court
Southern District of N.Y.

American Graphophone Company
s.
National Gramophone Co. and
Frank Seaman.

COMPLAINANT'S EXHIBIT GRAMOPHONE PAMPHLET.

Notary Public,
District of Columbia.

Exhibit #2 - S.J.C.

THE GRAM-O-PHONE and HOW TO USE IT

No. 18—'99 Model

JOHN F. ELLIS & CO.,
937 PENNA. AVE. WASHINGTON, D. C.

D
7063

YOUR NAME AND ADDRESS CLEARLY ON THE OUTSIDE, and prepaying the express charges. We will make no charge for our time in overhauling the mechanism, and any parts that are broken will be supplied at our lowest price. The Gram-o-phone will be returned to you at the earliest possible moment.

If you reside at a great distance from New York, and the expressage is a somewhat formidable item, take the instrument to your clockmaker; he will tell you what parts are broken, and we will supply them at the lowest price; your clockmaker can then insert them for you.

MAIN-SPRING

When shipped alone, or in nickel spring cage, the main-spring is held in position by means of a metal ring. This ring should be left on the spring until the spring cage has been placed in position, fastened to the base board and connected with the mechanism. The spring should then be wound tightly; this will release the ring, and by slipping it to the top of the spring it can readily be removed by means of the opening in one side of the ring.

THE GRAM-O-PHONE

The simplicity of the Gram-o-phone is such that any one who carefully reads the following description and instructions will be able to set it up, keep it in perfect order, and obtain from it the best results.

Plate 1

OILING THE GRAM-O-PHONE

Should it become necessary to oil the motor, unscrew the record-clamp and remove the turn-table A B, as in illustration No. 12. Drop a little oil in the hole D, as shown in illustration No. 13.

On leaving the factory the speed-adjusting rod C is screwed down tightly, so that the turn-table cannot revolve. In order to release the mechanism it is necessary merely to turn this rod to the left.

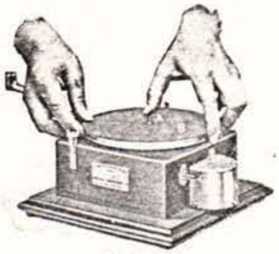


Plate 12

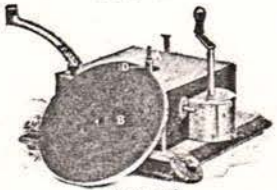


Plate 13

2. THE RECORD-DISCS. These are of black vulcanized rubber, one-eighth of an inch thick and seven inches in diameter, with a hole in the middle for the pivot of the turn-table to go through.

Plate 3

3. THE NICKEL-PLATED STEEL ARM on which the wooden arm rests. This is fastened to the base of the motor box by means of the two bolts which will be found with it.

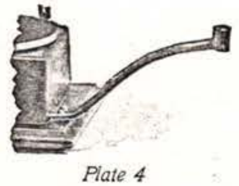


Plate 4

PLACING THE NICKEL ARM

This is attached to the base of the motor-box by means of the two bolts furnished with the arm; two holes will be found in the base of the motor-box, at the front, to accommodate these two bolts.

PLACING THE WOODEN ARM

The operator takes a position at the rear of the instrument, as shown in illustration on cover. At the outer end of the nickel arm will be found a small hole into which the swivel at the end of the wooden arm can be inserted, thus:

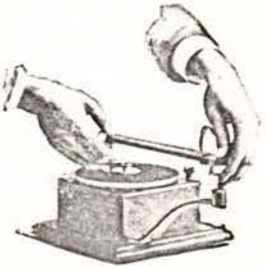


Plate 9

PLACING THE SOUND-BOX.

Take the sound-box in the right hand and force the tube into the open spring at the end of the wooden arm, then turn the entire sound-box to the right until the small metal peg will allow it to go no farther, thus:

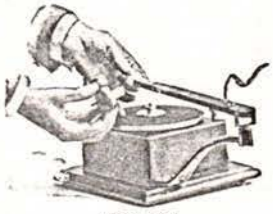


Plate 10

PLACING THE HORN

Turn the rubber covered wire horn rest to the left and lay the large end of the horn upon it; then gently force the protruding end of the sound-box tube into the small end of the leather elbow at the end of the horn, thus:

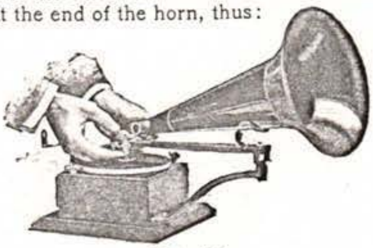


Plate 11

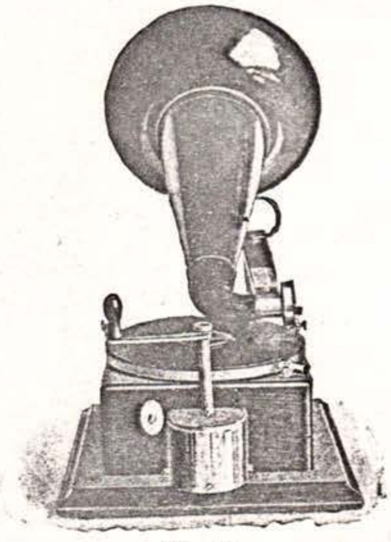


Plate 14

SHOWING GRAM-O-PHONE SET UP AND IN PROPER POSITION TO BEGIN PLAYING

JOHN F. ELLIS & CO.,

Exhibit #2 - S.J.C.

THE GRAM-O-PHONE and HOW TO USE IT

No. 18—'99 Model

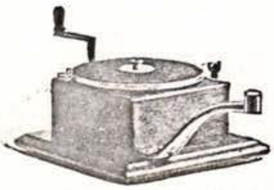
Compt [illegible] to
[illegible] phone Pamphlets

JOHN F. ELLIS & CO.,

DESCRIPTION

The principal parts of the Gram-o-phone are as follows:

1. THE SPRING MOTOR. This furnishes the power to revolve the turn-table; it is contained in a square wooden case, which it is not necessary to open, as the motor very seldom requires attention; and, with the exception of winding and regulating the speed, has only to be let alone. On top of the motor case is the turn-table, covered with cloth, on which the record-discs are to be fastened by means of a circular clamp screwed down over a central pivot. When not in use the turn-table is prevented from moving by a simple brake situated at the rear of the instrument, on the upper right-hand corner.



MOTOR BOX.—*Plate 2*

REPAIRS

Unless you are an expert mechanic do not attempt to repair the Gram-o-phone yourself. We always stand ready to put your Gram-o-phone in perfect repair free of charge, EXCEPT FOR PARTS THAT ARE BROKEN AND HAVE TO BE REPLACED.

If at any time the reproductions are indistinct, and the trouble lies in the sound-box, pack it securely in a small box filled with cotton, and send it to us, MARKING YOUR NAME AND ADDRESS ON THE WRAPPER; we will then put it in perfect repair, making no charge except for parts that are broken and have to be replaced.

If the sound-box is apparently in good condition, allow the turn-table to revolve at a speed of about seventy revolutions per minute without a record upon it; if there is a rumbling or rasping sound the difficulty is undoubtedly in the motor, which should be sent to us for repairs.

When returning the Gram-o-phone to us pack it carefully in a box, MARKING,

4. THE WOODEN ARM, OR TRAVELER, to which the sound-box and horn are attached.

Plate 5

5. THE SOUND-BOX, containing the reproducing diaphragm, to which the sound-waves etched on the record are communicated by the needle-point.

Plate 6

6. THE NEEDLE-POINT.
7. THE HORN.

Plate 7

Be sure to start the needle at the right-hand edge of the record, so that the disc is receding from the point of the needle, as otherwise the sharp point will plough into and destroy the record.

RECORDS

Our records are practically indestructible, but if one needle is used too often its dull point is apt to injure the more delicate sound-waves recorded on the disc, and as needles cost less than records, it is economy to use plenty of needles. One needle should not be used more than twice.

Don't
be
Needle
wise
and
Record
foolish

Now place the sound-box in the small crotched rest at the left, where it will remain secure.

Wind the Gram-o-phone by means of the crank-shaped key, being careful not to force the spring too tight; release the turn-table by lifting the brake-lever at the left, and then regulate the speed-adjusting rod, which is at the left of the nickel-plated spring-cage, turning the rod to the right for slower, and to the left for higher speed, until the turn-table is revolving at about seventy turns a minute.

The instrument is now ready for playing. The operator should remain at the rear of the instrument with the key and nickel spring-cage towards him, and the horn pointing in front of and away from him; then place the record on turn-table, and secure it in position by screwing circular clamp, not too firmly, on the central pivot; insert needle in needle-arm by releasing set screw, and fasten firmly.

Place sound-box at right-hand edge of the record, at the side nearest the brake, being particular to see that that the needle is in the first groove.

The mechanism should be in motion when the needle is placed on the record.

TO SET UP THE GRAM-O-PHONE

The Gram-o-phone, when it leaves our warerooms, is securely packed in a strong wooden case; all parts are detached and so distributed about the case as to render injury almost impossible. The case should be opened carefully and the parts compared with the foregoing illustrations, in order that no portion may be overlooked. Be particular not to overlook or lose anything packed in the horn.

The instrument is then ready for assembling as follows:

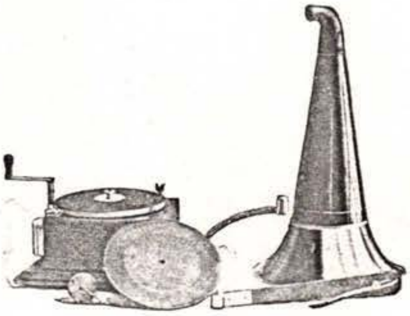


Plate 8

If, when setting up the Gram-o-phone, you are in doubt on any point, drop us a line, and we will take pleasure in giving you all the information in our power. It is to our interest to have every Gram-o-phone user thoroughly understand the instrument, and we stand ready cheerfully to answer all questions at any time.

⁂

NATIONAL
GRAM-O-PHONE CORPORATION,
874 Broadway, New York.

⁂

THE GRAM-O-PHONE

The simplicity of the Gram-o-phone is such that any one who carefully reads the following description and instructions will be able to set it up, keep it in perfect order, and obtain from it the best results.

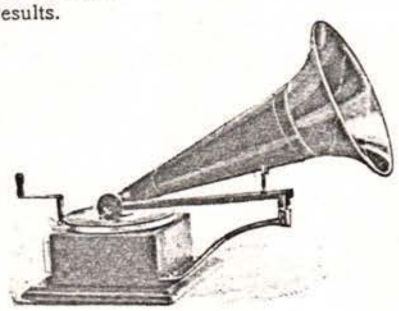


Plate 1

CERTIFICATE OF INCORPORATION

of

NATIONAL GRAMOPHONE COMPANY.

We, the undersigned, desiring to form a corporation pursuant to the provisions of the Business Corporations Law, all being of full age, citizens of the United States, and residents of the State of New York, do hereby certify:

First: The name of the proposed corporation is National Gramophone Company.

Second: The purposes for which it is to be formed are; to purchase and take over a contract or contracts for the sale and introduction of gramophones, and the license, exclusive or other, to introduce and sell the same, granted, or which may be hereafter granted by the Berliner Gramophone Company, a corporation organized and doing business under the laws of the State of Virginia, or any other corporation or person for the introduction of any gramophones, for the exclusive manufacture, sale or use whereof said company or companies, person or persons, may own patents issued by the United States of America, or of any other similar instrument or instruments for recording or reproducing sounds; to manufacture, own, sell, lease and operate gramophones, gramophone goods and other applicances useful in, or connected therewith; to purchase and own material to be used in the manufacture, production or operation thereof; to own, hold and control patents, United States and foreign, issued and to be issued for and upon such articles, and upon processes and systems for the manufacture or production thereof or the accomplishment of results produced thereby; to license others to prosecute such business and use said inventions and appliances, so far as may be consistent with the right which may be acquired by it; to introduce and exploit such inventions and manufactures, and to own and control patents, inventions and discoveries useful for that purpose:

to manufacture, deal in and sell articles which may be manufadtured and buy and sell articles which may be advantageously by bought and sold in connection with said business; to purchase and sell machinery and other property necessary or convenient in the transaction of the business of this company; to own, control, sell and deal in stocks and bonds of corporations using such machines, appliances, inventions; to deal in or with them, or any of them, so far as this may be done in accordance with the laws of the State of New York, and as shall be useful or adavantageous in conducting the business of the company; to buy or lease lands and buildings for the conduct of such business, and mortgage, lease or sell the same if expedient; to raise means for the conduct of such business by the issuing of bonds or other obligations, and to mortgage for that purpose, the charter and franchises of this corporation; and in general, to do and perform any and all acts and negotiate and carry out any and all contracts and arrangements which shall be deemed by its directors or officers necessary, convenient or advantageous therein or thereto.

Third: The amount of the capital stock is Fifty thousand (50,000) Dollars.

Fourth: The number of shares of which the capital stock shall consist is five hundred (500), and the amount of capital with which said corporation will begin business is Fifty thousand (50,000) Dollars.

Fifth: The location of its principal office is to be in the City of Yonkers, County of Westchester and State of New York, and its business is also to be carried on in the Cities of New York and Brooklyn, and throughout the United States of America.

Sixth: Its duration is to be fifteen years.

Seventh: The number of its directors is to be three.

Eighth: The names and post-office addresses of the directors for the first year are as follows:

Names.	Post-office addresses.
Frank Seaman,	Yonkers, New york.
Harry Bentz,	113 West 76th Street, New York, New York.
William B. Owen,	1 Gramercy Park, New York, New York.

Ninth: The names and post-office addresses of the subscribers, and the number of shares which each agrees to take in the corporation are as follows:

Names.	Post-office addresses.	Number of shares.
Frank Seaman,	Yonkers, N. Y.	498
Harry Bentz,	New York City, N. Y.	1.
William B. Owen,	New York City, N. Y.	1.

IN WITNESS WHEREOF we have made, signed and acknowledged this certificate this 19th day of October, 1896.

Frank Seaman
Harry Bentz
William Barry Owen.

State of New York,

City and County of New York, ss:

On this 19 day of October, 1896, before me, the subscriber, personally came Frank Seaman, Harry Bentz and William B. Owen, to me known, and known to me personally to be the individuals described in and who executed the foregoing certificate, and severally acknowledged that they executed the same.

F C Hardy

Notary Public

Kings Co.

(Seal) Certif filed in N Y Co.

(Endorsed)

THE NATIONAL GRAMOPHONE COMPANY.

CERTIFICATE OF INCORPORATION.

Tax for privilege of organization
of this Corporation.
$62 50/100
Under Chapter 908, Laws of 1896.
Paid to
State Treasurer before Filing.

STATE OF NEW YORK.
Office of Secretary of State
FILED AND
RECORDED Oct. 28 1896
Andrew Davidson.
DEPUTY SECRETARY OF STATE.

State of New York, } *ss:*
CITY AND COUNTY OF NEW YORK, }

Form 3.

I, **EDWARD F. REILLY,** Clerk of the City and County of New York, and also Clerk of the Supreme Court for the said City and County, the same being a Court of Record, DO HEREBY CERTIFY, That F. C. Hardy, has filed in the Clerk's office of the County of New York, a certified copy of his appointment as Notary Public for the County of Kings, with his autograph signature, and was at the time of taking the proof or acknowledgment of the annexed Instrument, duly authorized to take the same. And further, that I am well acquainted with the handwriting of such Notary, and verily believe the signature to the said certificate of proof or acknowledgment to be genuine.

[SEAL.] In Testimony Whereof, I have hereunto set my hand and affixed the Seal of the said Court and County, the 24 day of Oct. 1896.

~~EDWARD F. REILLY~~, *Clerk.*

140-12-S-'97-2000. 14343

State of New York,
OFFICE OF THE SECRETARY OF STATE. } *ss:*

I have compared the preceding with the original Certificate of Incorporation of National Gramophone Company, *filed and recorded in this office on the* 28th *day of* October, *18*96, *and do HEREBY CERTIFY the same to be a correct transcript therefrom and of the whole of said original.*

Witness, *my hand and the Seal of Office of the Secretary of State, at the City of Albany, this* 11th *day of* November, *one thousand eight hundred and ninety-eight.*

Deputy *Secretary of State.*

UNITED STATES CIRCUIT COURT,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY, Complainant,
vs.
THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMANN.
} In Equity

DEFENDANT'S BRIEF ON MOTION FOR PRELIMINARY INJUNCTION.

BY MR. GUSTAV BISSING.

May it please the Court:

This is a motion for a preliminary injunction against an alleged infringement of the Bell & Tainter Patent No. 341,214, and more especially of Claims 19 to 23 of said patent, which were recently sustained as valid by Judge SHIPMAN in the case of the American Graphophone Company vs. Leeds (87 Federal Reporter, 873), and two of which have been held valid by Judge GROSCUP in the Amet case (76 O. G., 1273; 74 F. R., 789).

The validity of these claims, as we understand them to have been construed by Judges SHIPMAN and GROSCUP is not contested for the purposes of this motion. The points urged by the defendant are, on the other hand, first, the fact that the construction which Judges SHIPMAN and GROSCUP gave to these claims is such as to manifestly free the defendant's device from their control; second, that the questions necessary to be decided in order to bring the defendant's device within the terms of complainant's claims, if that were possible, have never been considered by any Court; third, that there is no infringement of complainant's claims, however construed, and, fourth, that under all the circumstances of the case, which will be set out at large, the grant of a preliminary injunction would be inequitable.

In order to properly understand the scope of the claims of the patent on which an injunction is asked it will be necessary to consider, briefly, the improvements which these claims are designed to cover, and to do this we have to consider the prior art.

The Edison Phonograph, as pointed out in Judge SHIPMAN'S decision, embodies a machine which both records and reproduces speech. The record, in this case, was made by indenting it upon the surface of a yielding material, such as paper saturated or coated with something like paraffine and covered by a sheet of tinfoil. The tinfoil received an impression from an indenting point secured to the centre of a rigidly-mounted diaphragm. The difficulty was that the material of the tinfoil was pliable and that the indenting point bent the tinfoil down and around the point of contact and thus distorted the indentations. Besides, the record is said to have been perishable and easily obliterated and easily injured when removed from the machine, and after a short time the indenting process fell into disuse. Nevertheless, we have in Edison a record adapted for reproducing sound, in which the sound is represented by a groove with an undulating bottom, which undulating bottom gives motion to a sound-reproducing stylus in a direction perpendicular to the face of the record.

Bell & Tainter improved this device of Edison into the well-known Graphophone. They did this by discarding the tinfoil and using instead a wax or wax-like material into which the record was engraved or cut by boldly removing chips of the substance of the material, as distinguished from the process of indentation as used by Edison. The wax or wax-like material was, on the one hand, supposed to be soft enough not to offer any undue resistance to the engraving or cutting stylus in the act of recording sound, and was, on the other hand, considered by them so hard that the record should not be readily injured or be readily worn out by the reproducing stylus in the reproducing operation. The sound record on the wax cylinder of Bell & Tainter is found at the bottom of the record groove, just as in Edison. So, too, the vibrations are imparted to a stylus in a direction perpendicular to the surface of the record cylinder, just as in Edison. The operation of reproducing sound with Bell and Tainter's wax-like cylinder and with Edison's tinfoil-covered cylinder is precisely the same. Nevertheless, the difference in the material used by Bell and Tainter, wax as against tinfoil, and the difference in the method of cutting the record as distinguished from indenting it, have been held, so far as the question has yet been litigated, to have created such an advance in the art as to entitle the wax cylinder of Bell and Tainter, carrying their engraved sound record, to be regarded as a useful invention. As such it has been sustained by Judge GROSCUP and by Judge SHIPMAN in the cases above referred to, and by Judge WHEELER in the case of the American Graphophone Company vs. Walcutt, 87 Fed. Rep., 551.

There was another thing necessary to be done in order to make the Phonograph of Edison successful as a reproducer of speech, and what this was will best appear from a study of the shape of the record grooves of Bell and Tainter's wax cylinder as manufactured by the complainant. A photograph on a very much enlarged scale, obtained by a process of micro photography, is appended to the Lyons affidavit and is marked "Chapman Microphotograph Graphophone Grooves." This photograph, it is to be understood, shows the appearance of the grooves of the Graphophone wax cylinder as they appear in cross-section, the cut being made not in the direction of the length of the grooves but across a number of consecutive grooves at right angles to the grooves, and in a direction paralle to the axis of the cylinder. The photograph show that these grooves are exceedingly shallow an very broad in comparison with their depth I furthermore shows that there are ridges betwee the grooves about as well defined as the groove themselves, the sides of two adjacent grooves, i fact, coalescing into a more or less sharply defin ridge.

At this point we wish, once and for all, to ins upon a matter which completely disposes of con

Phonoscope 11/98

plainant's contention in his present motion. It is this: that no decision which has ever been rendered by any Court, sustaining the Bell & Tainter patent in suit, has gone beyond the specific wax-like material with an engraved record having sloping walls and having the record in the undulating bottom of the groove. In none of the adjudicated cases did any of the defendants use anything but such a wax-like record in which grooves, of the specified shape, were cut or engraved. Therefore, in none of the adjudicated cases was it necessary to decide more than the novelty of this one feature, and if more had been decided it would have been a mere *obiter*. But the fact is, and it will abundantly appear hereafter, that the Courts, in the adjudicated cases, did not attempt to go beyond the wax-like record with the engraved groove of the specified shape. This element, either by itself or in combination with another element, has been the basis of every decision sustaining the patent. No adjudicated case holds a device which does not employ such wax-like record as an infringement. We deem it unnecessary to repeat this matter again and again throughout the course of this brief, but insist here that this alone disposes of the present motion adversely to complainants, for the defendants employ neither a wax-like record nor has their record engraved grooves nor grooves of the shape of those used by complainant.

Now, with a wax record having a groove of the shape shown in the Chapman photograph, and, be it always remembered, with a sound record at the very bottom of the groove, it would manifestly be a very difficult thing to construct a machine carrying the diaphragm and stylus in a rigid and unyielding manner in which the construction should be so exact that the stylus would always rest at the bottom of this very broad and very shallow groove. Bell and Tainter, therefore, conceived of a simple method of overcoming the difficulty, which consists, in effect, in giving a very small amount of lateral play to the mounting for the diaphragm, so that when the stylus is placed within the purview of the record groove, whether near the top or near the bottom of the side wall, then by the simple process of tapping the wax cylinder, or by the jar incident to the motion of the cylinder, the stylus will of itself gravitate to the bottom of this groove.

This method of mounting the stylus, embodying a trifling amount of lost motion in a lateral direction, has besides the advantage that if the stylus, when placed upon the wax cylinder, should happen to rest on the ridge between two adjacent grooves, that then the same process of tapping the cylinder will cause the stylus to slide down into one or other of the two adjacent grooves. As the Graphophone wax cylinder in ordinary practice has about one hundred helical turns of the record groove to the inch, it will be seen, in order that the stylus may be able to effect the function which we have just described, of automatically gravitating to the bottom of a preselected groove, when the stylus is resting on the side walls of the groove, or of falling into one of two adjacent grooves, when the stylus is placed on the ridge between the grooves, that the amount of necessary lateral play is exceedingly slight, being at most one hundredth of an inch, though in the commercial construction it may be a trifle more than this. In the Patent No. 341,214 it is shown as effected by a small bit of rubber tubing, numbered 32, and well shown in Fig. 8.

That we have correctly stated the functions of this lateral adjustment of the mounting for the stylus appears on page 4 of the patent in suit, from which we quote as follows:

> "No special care is necessary to insure its adjustment [meaning the reproducer], for, if the reproducer K be allowed to rest against the record with the style upon the engraved line, the style will of itself gravitate to the *bottom of the groove.*"

Or again, from the same page:

> "Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the record."

The truth of the facts relating to the lateral adjustment more fully appears from the testimony of Mr. Charles S. Tainter in the Leeds case, who testifies that he was the Sumner Tainter who is one of the grantees of the patent in suit. In answer to question 7 of his direct examination, and in answer to questions 24, 25, 26 and 27 of his cross-examination, this patentee fully goes into this matter. While we consider it desirable that all of these questions and cross-questions be considered, we limit ourselves to a quotation of Mr. Tainter's answer to question No. 7 as follows:

Continued in our next

UNITED STATES CIRCUIT COURT,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY, Complainant,
vs.
THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMANN.
In Equity

DEFENDANT'S BRIEF ON MOTION FOR PRELIMINARY INJUNCTION.

BY MR. GUSTAV BISSING.

(Continued)

"The difficulty of tracking the groove increases as its width and depth diminish. With record grooves equal in size and shape, the reproducer will follow a pitch of ten to the inch as readily as it will one of one hundred; but should the reproducer, for any reason, leave the groove it might, in the case of the course pitch travel along on the surface of the record cylinder between the grooves, while with the fine pitch the space between grooves being too narrow to support the reproducer the motion of the cylinder throws it to one side or the other and into the groove. If, in the case of the coarse pitch the width of the groove is made equal to the *pitch*, the tracking will be less difficult than in the case of the finer pitch, as there is no place for the reproducer to rest outside the groove, and when the groove is large it is more effective in guiding the reproducer. A disturbance that would throw the reproducer out of a fine groove would not interfere with the tracking of the large one. We were for a long time embarrassed in our work by the difficulty of reproducing from a narrow and shallow record. On the one hand, the success of the method of engraving depended upon reducing to a very fine hair-like line the cross-section of the record groove. On the other hand, it was utterly impossible with the reproducing instrumentalities of the time to reproduce from such a record. This difficulty was so great that we gave up for a time all hope of producing satisfactory results by the rubbing method of reproducing and made numerous experiments with other methods, as by jets of air and other fluids. After conceiving the idea of the yielding pressure reproducer, which brought us back to the rubbing method, it required a great number of experiments to determine the construction of a reproducer which would automatically track such a fine groove as could be made by the engraving method and maintain constant contact therewith at uniform pressure."

What Mr. Tainter here says about a narrow groove requires a word of explanation. Manifestly he needed a groove which was narrow in an absolute sense measured by the ordinary standard of things about us. But the Chapman photograph sufficiently shows that his groove, in a sense relative to the depth, was quite broad. Nor should confusion arise from the shape of the cutting style shown in the Bell & Tainter Patent. The style there shown has sides meeting at an acute angle. But it is to be remembered that only the extreme point of the style operates in cutting, for the depth of the record grooves in the wax cylinder is not over one five-hundredth of an inch. So small a dimension it would be impossible to indicate in a drawing made to scale, which is the case with the drawings showing the cutting tools in the patent. How the extreme point is shaped, the patent does not and cannot tell. The Chapman photograph shows how the tool must have

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been shaped to make the blank which was bought from the agents of complainant's corporation. This, then, disposes of the lateral adjustment of the stylus mounting.

But in addition to the slight flexibility laterally, it is manifestly also necessary to have a flexibility to the support of the stylus in a vertical direction toward and from the bottom of the record groove, for manifestly if the diaphragm be rigidly mounted in a vertical direction then it would be necessary to so adjust it that normally the point of the stylus will reach to the bottom of the deepest record groove. When, therefore, the shallower record grooves come into play, there will be a useless amount of friction and wear and a corresponding distortion of the record. Therefore, Bell and Tainter allowed sufficient flexibility in a vertical direction in mounting their reproducing stylus, so that the stylus could gravitate to the bottom of the groove and could rest with a yielding pressure against the record at the bottom of the groove. Manifestly, we repeat, the whole idea of Bell and Tainter's construction is to have the reproducing stylus rest with a yielding pressure against the bottom of the groove, for here their record is found and here the undulating line imparts motion to the stylus in a direction perpendicular to the surface of the wax cylinder. Both the lateral and the vertical flexibility of Bell and Tainter's universal joint, then, assist in permitting the stylus to get to the bottom of the record groove. This is the sum and substance of the function of the flexible mounting for the reproducing stylus.

This, then, was the second feature of the invention claimed by Bell and Tainter, namely, the combination with their wax cylinder of a loose mounting in a lateral and vertical direction in the suppport for the stylus, having, it is true, an exceedingly minute compass, but still a compass large enough to enable the stylus to automatically fall into one of the two adjacent grooves from the ridge between the grooves, or, when placed within the purview of the groove, to gravitate down the very slightly inclined and rather wide side wall of the groove to the bottom of the groove, where the sound record is actually found. The peculiar shape of the sound-record groove of Bell and Tainter, shallow and exceedingly wide in comparison, was made necessary by the fact that, with the engraving or cutting process, a deep groove would have encountered so much resistance in the recording operation as to make the sound record untrue to the original sound. A shallow groove was necessary. This shallow groove, however, required some means by which the stylus could be automatically guided to the bottom of the groove, and that means, as adopted by Bell and Tainter, was the loose mounting of the stylus support. This flexiblie or universal mounting, as we have said, has a compass not necessarily larger than one one-hundredth of an inch.

The combination of the peculiar wax-like sound record of Bell and Tainter with the flexible or universal mounting for the reproducing stylus which we have described has been held patentable both by Judge GROSCUP and by Judge SHIPMAN; and, so far as we are aware, these two features—the wax cylinder with a cut or engraved record of the shape described *per se* and the wax cylinder with a cut or engraved record of the shape described in combination with the flexibly mounted stylus—are all that have been held patentable up to the present time to Bell or Tainter by any United States Court.

We may now turn to the work of Mr. Emile Berliner as embodied in the well-known Gramophone, the infringing character of which is alleged in the bill of complaint.

Just as Bell and Tainter found the basic ideas of their invention in the Edison Phonograph and just as they, adopted certain changes to make this type of Phonograph successful, so Berliner found the basic ideas of his invention in the Scott Phonautograph and later in the theories of the Frenchman Cros, and after years of experiment hit upon plans which put the impractical and uncommercial ideas of these earlier scientists into practical and commercial form.

The Scott Phonautograph, which is well known to students of science and is described in the Lyons affidavit and in the Berliner Franklin Institute lecture, is a device for recording but not for reproducing speech. It consists of a membrane carrying a stylus, which bears against a rotating cylinder covered with lamp black. As the cylinder rotates, sounds are uttered in the vicinity of the diaphragm and the diaphragm is set into vibration. By means of these vibrations the style removes the lamp black in the cylinder along an undulatory line. The action is precisely like that of writing with a stylus on a smoked-glass plate. The stylus does not move perpendicular to the surface carrying the lamp black, so as to make a groove with an undulating bottom or a groove of varying depth, but, we repeat, the style is moved laterally only, so as to make a laterally undulating line upon the surface of the cylinder, which accurately pictures the sound which has been uttered against the diaphragm.

The French Cros carried Scott's idea further, and attempted not only to record sound in the manner set out by Scott, but also to reproduce the sound thus recorded. Without going here at large into the processes detailed by Cros, which are fully set out in the affidavit of Mr. Lyons, it may be said that he suggested the inscription of the sound record along a latterally undulating line on the surface of a smoked plate, and then, by a process of photo-engraving, the making of a metal plate carrying in its face a groove of even depth, but with lateral undulations corresponding to the sound waves. From this groove of even depth, with the sound record on the side walls thereof, he proposed to reproduce the sound.

That is to say, while the Edison Phonograph had the sound record in the form of a groove with an undulating bottom, Cros' idea was to have the sound record along the sides of a groove, the bottom of which was entirely even. So, too, while Edison reproduced by moving a reproducing stylus perpendicular to the face of the record material, Cros proposed to reproduce by moving the stylus laterally in a direction parallel to the face of the record material. Now, Berliner, after four years of constant experiment, devoted to this subject alone, was enabled, without departing from the fundamental principle of Cros, to put his ideas into practical form, just as Bell and Tainter, after their experiments, succeeded in putting the ideas of Edison into practical form without departing from the fundamental principle of Edion.

Berliner, although ignorant of Cros' work until after his own experiments had well progressed, effected this improvement on the Cros conception by using, as his original record plate, a zinc plate covered with a very thin fatty film instead of Cros' smoked glass plate, which fatty film Berliner removes along a laterally undulating line of even depth by the recording stylus. After having removed the material of the fatty film along the laterally undulating line, the zinc plate is placed in an etching bath, and the material of the zinc plate is eaten out along a groove having undulations in a lateral direction, but having a uniform depth, depending merely upon the time of the immersion of the zinc plate in the etching bath. When the groove has been etched to a sufficient depth, the zinc plate is removed from the etching bath and placed in an electro-plating bath, where it is electroplated with copper. The copper plate thus obtained has on its face, in a raised form, a ridge of even height, but with lateral undulations corresponding to the sound record. This copper plate is then used to impress the sound record into hard rubber plates, which have been temporarily softened by heat. One copper plate may thus be used to impress as many as a thousand rubber plates. Each rubber plate carries the sound record in the form of a spiral groove of even depth with lateral undulations corresponding to the sound record.

Such a hard rubber plate is one of the important inventions of Mr. Berliner and is covered in his Patent No. 548,623, dated October 29, 1895, a copy of which is annexed to defendant's affidavits. Its advantages are obvious. First of all it carries a more accurate representation of the sound than any record tablet yet devised. This is due to the fact that there is no substantial resistance to the motion of the recording stylus in recording sound, for the fatty film on the zinc plate may be made almost infinitesimally thin, and what little resistance there is must be uniform. In the Phonograph wax records, the wax offers considerable resistance to the recording stylus, for the groove must be of appreciable depth in order to do good work in reproducing and besides the resistance to the recording stylus varies with the depth of penetration, so that the sound record is distorted to this extent. Again, the rubber record is hard and indestructible, so much so that the indentation by the copper plate must be effected when it has been softened by heat. It would be physically impossible to cut or engrave it with a stylus actuated by sound vibrations. Again, it has the capacity for unlimited reproduction in a cheap and simple manner, one pressure with the copper plate impressing the entire record of all the sounds. In the wax record, each record must be made separately by directly cutting the sound record upon it, sound by sound. Again, since the record in Mr. Berliner's rubber plate is at the sides of the groove instead of the bottom, the stylus need not, and does not, bear with any pressure against the record on the side walls of the groove, so that there is no distortion of sound in reproducing due to initial pressure and consequent friction.

But there is another feature of Mr. Berliner's invention in which he improves on Cros and that is the combination of the peculiar hard-rubber record which we have described with the mounting for his reproducing stylus. As appears from Mr. Berliner's patents, and also from the model exhibit of the Gramophone, Mr. Berliner has discarded all the screws and gears used by prior inventors and all of the complications incident thereto, among them the necessity for the minute lateral and vertical play of the Bell and Tainter joint, and has boldly caused the record groove itself to do the work of *propelling* the stylus and the whole reproducing apparatus from its outermost to its innermost convolutions. This invention is also one of a most important and valuable character. It dispenses with all the complications considered necessary before his invention thereof in a manner as simple as it is possible to conceive. This idea has been patented to Mr. Berliner in his Patent No. 534,543, and more particularly in claim No. 5. It has been considered by all who have had reason to examine the subject as one of the great steps in the art of sound reproduction.

If we consider the history of the two inventions of Bell & Tainter Graphophone and of the Berliner Gramophone, it will be apparent to any one skilled in patent matters, from the very history of the art, that there can be no conflict between two inventions developed along such different lines. It is apparent, without any technical consideration of claims or patent specifications, that nothing which Bell & Tainter has done can interfere with the work of Berliner. Berliner started from Scott and developed the ideas of Cros. Bell & Tainter started from Edison and developed the ideas of Edison. Berliner converted the theories of Cros into a practical sound-reproducing machine. Bell & Tainter converted the ideas of Edison into the practical Graphophone.

Berliner, among other things, took the metal record of Cros, with its laterally undulating grooves of even depth, and, by many improvements on the processes of Cros, converted it into a hard-rubber record with a laterally undulating groove of even depth. Bell & Tainter took the tin foil cylinder of Edison with its groove having an undulating bottom and converted it into a wax cylinder with a groove having undulating bottom. Berliner used a mounting for his reproducing stylus, which should have a compass from the innermost convolutions to the outermost convolutions of the record, so that the stylus would be propelled across the whole record by the groove without the necessity of screws and gears. Bell & Tainter took the rigidly-supported stylus of Edison, and, while retaining the screws and gears of Edison, gave it the tiniest possible amount of play, so that the stylus would automatically adjust itself to the bottom of the record groove.

We need merely inspect the Chapman photographs which show a cross-section of the record grooves of the Bell & Tainter wax cylinder and of the Berliner hard-rubber plates to convince ourselves that the only possible argument, however stretched it may be, which could be advanced in favor of a conflict between the Bell & Tainter and Berliner inventions has no foundation in fact. This argument manifestly is that since the lateral adjustment of mounting which Berliner employs for his stylus is wide enough to take in all of his grooves, that it must also be wide enough to take in a single groove or two adjacent grooves, and therefore, this lateral motion will permit of an adjustment of the stylus within the record groove. But when we come to examine the photographs, we find that whereas the record grooves of the Graphophone wax cylinder are very shallow and have a long slope, very much like the roll of a gently undulating prairie, the record grooves of Berliner are like little cup-shaped depressions in an absolutely flat plane. In the Berliner tablet there is a U-shaped groove or perhaps a semicircular groove, and between two adjacent grooves there is an absolutely flat space about two times as wide as the width of a single groove. Furthermore, the stylus substantially, though loosely, fits the Gramophone groove. This being the case, it is manifestly a stretch of language to talk about adjusting the Gramophone stylus within the Gramphone groove. You might as well talk about adjusting a billiard ball in the pocket of a billiard table. You put the ball over the pocket and let it drop into it; that is all the adjustment there is. So in case of the Gramophone stylus, you put the stylus over the groove and let it drop in, and when it gets in it stays there. There is only one place for it, and that is the right place. Nor is it possible to have the Gramophone stylus automatically select between two adjacent grooves, because if, in the Gramophone, the reproducing stylus falls on the flat space shown in the photograph between two adjacent grooves, it would stay there, and no amount of tapping and shaking could get it off this flat portion. When on the other hand, we look at the photographs of the Graphophone grooves and see that here there is not a question of simply putting a stylus into one place, where it naturally belongs, but that it is a question of putting the stylus on any one of a dozen places, whether on the ridge between the two adjacent grooves or anywhere along the side walls of the groove, we can readily imagine what the automatic adjustment of this stylus to the bottom of the groove means. There are twenty places where the stylus may go, and only one right place, and this right place is found, automatically, by the loose adjustment of the stylus.

To make this matter still more clear, we need only refer to the common practice, necessary with every Graphophone of tapping the instrument every now and then, so as to shake the stylus down into the bottom of the record groove. Any one who has long used a Graphophone, is familiar with this practice. It brings about the functions upon which Bell & Tainter have laid so much stress, of automatically adjusting the stylus to the bottom of the record groove. But there is no need for such tapping in a Gramophone. All you have to do is to look at the instrument and see that it would be useless. The stylus fits the groove when it is in place. If the stylus is not in place tapping cannot help you. If the stylus is in place, then tapping is unnecessary. So, whether the stylus is in the groove or out of the groove, on the flat space between two grooves, there is no use of tapping, which means there is no automatic adjustment of the stylus. The attempts of complainants' experts to make out such an automatic adjustment would never have been made had they made microscopic photographs of their own and defendants' devices.

We have thus shown the history of the development of the Graphophone and have shown the two ideas about it which have been held patentable, which are first, the *wax* cylinder with its *cut* record having a groove with an *undulating bottom* and *sloping walls;* and, second, the combination of this same wax cylinder with a mounting for the reproducing arm, having a minute amount of flexibility to admit of the automatic adjustment of the reproducing stylus along the gently sloping wall of the groove, so that it may find the bottom of the groove where the record is. We have set forth, too, the history of the Gramophone, the two features of most importance here being, first, the *hard rubber* record with a *lateral undulating groove* of *even depth* produced by *indentation*, and, second, the combination of this record with the mounting having a wide lateral range so as to propel the stylus from one end of the record to the other. We have finally shown that this lateral motion of the reproducer in the Gramophone has no function of effecting an automatic adjustment of the stylus either within a groove of a Gramophone record or between two adjacent grooves, and that there is no yielding or gravity pressure between the Gramophone stylus and the record which is formed at the side walls of the record groove. That is to say, we have shown that it is impossible for Bell and Tainter to have a patentable claim reading on a patentable improvement in their own device, which shall at the same time read on the Berliner Gramophone.

We have next to consider the decisions of the Courts to see whether they substantiate the views we have herein expressed, and here we first examine the opinion of Judge GROSCUP in the Amet case (74 F. R., 799.) After reciting the general principles which underly the operation of reproducing machines, Judge GROSCUP, in speaking of the labors of Bell & Tainter, says:

> "The chief mechanical problem before the inventors was the making of a suitable and practical substance of deposit or record."

The opinion then proceeds to point out the well-known character of their wax record with its cut or engraved groove and its sloping walls, and the general method by which sound reproduction is effected from such a record. Thereupon the opinion quotes claims 22 and 24 of the patent No. 341,214, and proceeds in the following language:

> "It will be seen that, in order to follow the groove accurately, the reproducer must be loosely mounted, and this is accomplished by the universal joint described in the patent. Much stress is laid by counsel for complainant upon the patentability of the adaptation of this universal joint to the purpose of the Graphophone.
> If the validity of the patent depended upon this contention I would be disposed to hold against it *for I can see nothing novel about the joint except its new use, and such adaptation to new use is not, in my judgement, patentable invention; but while this element, separately considered, is not invention, the combination which embraces it, in my judgement, is.*

We have here a clear statement to the effect that in the opinion of Judge GROSCUP the universal mounting of the reproducer in the Graphophone, when that reproducer is considered by itself and aside from the wax record, is not a patentable invention. We have furthermore the express holding of the Judge that the combination of this reproducer with the wax record is patentable, for it is to be remembered that the wax record was the only one before the Judge. To emphasize this point, we quote the following sentences from the decision.

> "Without complainant's record the defendant's device would be useless. It is never used except in connection with complainant's record. In the practical use, therefore, of defendant's device one of the elements of complainant's combination is actually and necessarily employed."

As further emphasizing the point that Judge GROSCUP considered the combination of the wax record and of a loosely mounted reproducer the patentable invention of the patent before him we quote the following (italics ours:)

> "The *substance* upon which the record is cut and the reproducer thus loosely mounted, by which it is enabled to follow the undulations of the groove, together constitute an effective portion of the mechanism. Either without the other would be useless for the purpose of a Graphophone or a Phonograph. Together they bring about a successful result. They therefore constitute a patentable combination."

We conclude by quoting the following sentence from the decree in the Amet case, found in Vol. 74 of the Federal Reporter, page 1008

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UNITED STATES CIRCUIT COURT,

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BY MR. GUSTAV BISSING.

(Continued)

"The Court further finds that any device which combines the reproducer described in claims 19, 20, 21, 22 or 24 of said patent with the groove tablet or other body having a sound record as described in said patent and especially in claims 22 and 24 is an infringement of complainant's patent No. 341,214."

Manifestly, then, if these complainants had to rely upon Judge GROSCUP'S decision, there is nothing in the construction which he gave to their claims which would hold the defendant's device as an infringement. The only record which was before Judge GROSCUP, as we have said, was the wax record with a cut or engraved sound groove, and it was this wax record in combination with the reproducer mounted so as to pres s by gravity upon the undulations at the bottom which was held to be a patentable combination and invention.

We have then to examine Judge SHIPMAN'S decision (87 F. R., p. 873). After quoting a number of the claims from the Bell & Tainter Patent No. 341,214, the opinion goes on to refer to the prior art and more expressly to the work of Cros and of Edison, whereupon it dismisses the French device from consideration and describes more specifically the work of Edison. The opinion thereupon proceeds to give a history of the work of Bell & Tainter. From this part of the decision we quote the following sentences:

> "The material of the record and the reproducer are each necessary parts of the invention. Either part without the other would be ineffectual, but in combination both tend to make an operative and successful instrument."

The opinion goes on to refer to Judge GROSCUP'S decision, and to emphasize the fact that Judge GROSCUP considers the combination of record and reproducer a patentable invention. Judge Shipman then says:

> "This peculiarity of the dual invention of the material for an engraved record and the reproducer and the fact that the latter was brought into being to make the former of practical value is of much importance in the proper construction of the quoted claims of the patent, if it should be held that the reproducer alone, though novel, is not patentable."

Thereupon the defenses to the claims of Bell & Tainter are discussed, and to this end the work of Edison, as shown for instance in his British Patent of 1878, is considered. Speaking of this work Judge SHIPMAN says:

> "He (meaning Edison) did not use, unless experimentally, the blank made of wax or a waxy substance which was to become *by itself* a sound record to be used for reproduction."

The Judge then goes on to consider the work of Cros which he does in the following language:

> "It is unnecessary to describe the theories of the French scientists in regard to the material for recording, because, while they used wax or stearine or paraffine upon the surface of the

recording cylinder made of metal or of glass, none of them attempted to reproduce the sound from the wax or paraffine or stearine record, but the reproduction was made from the metal surface.

> "The declaration in the specification that 'no one has reproduced sounds from a wax record by rubbing a style or reproducer over it' is true, and it is furthermore true that this combination, as shown in the patent in suit, either in method or operation or in the character of its result converted the noteworthy but short-lived instrument of Edison into a machine of widespread use and permanent utility."

Manifestly the Court here had in mind simply a sound reproducer in which the wax-like blank which had been originally used for recording could, by itself, be used for reproduction. That is to say, it had in mind a device of the character of Edison, and threw out of consideration devices like those of Cros in which the same tablet which is used for recording is not used for reproducing. But if Judge SHIPMAN threw out devices of this character as having no bearing on the question of anticipation of the Bell & Tainter claims, manifestly his Honor at the same time held in effect that the Bell & Tainter claims, as he construed them, would not be infringed by such a device; for it is well-settled law that things, when subsequent, which are an infringement of claims would, if prior in point of time, be an anticipation thereof.

After Judge SHIPMAN has fully disposed of the prior art and the various defenses, he sets forth the importance of the Bell & Tainter Patent in the following language:

> "The two improvements of importance, with respect to claims 19 to 24, inclusive, are the new *material* for a sound record upon which *vertical* undulating grooves with *sloping* walls were *engraved* by a *cutting* style; and the reproducer which rested upon these grooves *by gravity*, and moving along them, 'imparted to a second diaphragm the vibrations incident to the elevations and depressions *of the bottoms of the groove*.'"

The opinion again refers to the fact that Judge GROSCUP was not disposed to regard the adaption of the universal joint to the reproducer as patentable, when considered by itself. Judge SHIPMAN may have been inclined to the opinion that this universal joint of complainant in the reproducer might be patentable in itself, because as he said:

> "The style needed not only the lateral motion produced by the universal joint, but also an elastic and yielding pressure against the record."

We call attention to the fact that the purpose of the lateral movement in the Gramophone is entirely different from the purpose of the lateral movement in the Graphophone and, as is fully established by the affidavits, that there is no elastic and yielding pressure against the record in the Gramophone, because the record is on the side walls of the groove and the reproducing stylus loosely fits the said walls so that the pressure is all on the point of the stylus at the bottom of the groove, which is of even depth and is not the record. Even, therefore, if Judge SHIPMAN had made the holding that the universal mounting of the reproducer in the Graphophone is patentable *per se*, which he did not, such holding would not affect the question involved in the present motion, because the purposes and results which he attributed to the universal mounting are not found in defendant's machine. Judge SHIPMAN then goes on to say:

> "But if the reproducer is not patentable by itself, I fully agree with Judge GROSCUP'S idea of the patentable character of the combination which appears in these claims, and concur with him that any device which contains the reproducer described in claims 19 to 24 with a grooved tablet, or other body having a sound record *as described in the patent, and especially in claims 22 and 24*, is an infringement on the patent in suit."

This is substantially the language of the decree in the Amet case (74 F. R., 1008). Claim 22, be it noted, describes a reproducer having a rubbing stylus, which means a style having a certain amount of *initial* pressure against tha record surface over which it slides, which is not the case in the Gramophone. It furthermore specifies that the reproducer is free to move laterally to adjust itself to the groove and there is no such adjustment in the Gramophone. Claim 24, on the other hand, describes a record of wax or wax-like material, and there is no pretense that the defendants use such record. The motion papers herein expressly omit a reference to claim 24.

As conclusive proof of the fact that Judge SHIPMAN did not propose to give claims 19 to 24 of the patent in suit a construction as broad as the patentees may have hoped for, we quote the sentences immediately following those just quoted:

> "This construction is not so broad as that "which the solicitor for the patentees apparently "hoped for, but it limits the claims to the improvement which, *in combination*, created the new "machine, and which are abundantly described "in the specification."

Considering the question of infringement, Judge SHIPMAN held that a record made of metallic soap, the material being wax-like and capable of being cut like wax, was within the Bell & Tainter claims. Judge SHIPMAN also held that since the defendant's reproducing machine was designed solely for reproducing the wax-like sound records of the patent, it was an infringement of the claims in question.

Were further proof needed that the only questions heretofore in litigation have involved the peculiar wax record *per se*, or in combination, it will be furnished by the brief of these complainants in the Leeds case, extracts of which are found in the Brownell affidavit. We ask the attention of the Court to each of these extracts. In the extract taken from pages 4 and 5 we find the complainants to have contended that the chief merit of the self-adjusting reproducer of the Graphophone lies in the part it played in the development of the engraving method. But these defendants use no engraving method. In the extract taken from page 21 it is asserted that no records other than wax-like records were in use at the time the brief was written, being December 10, 1897. This with the full knowledge which Complainant's counsel had of the hard-rubber records of the Graphophone. In the extract taken from pages 22 and 23 we find it again insisted upon that the engraved record was the only one under consideration. In the extract from page 23, the complainants expressly urge that an issue involving a record other than an engraved record was not before the Court in the Leeds case, so far as claims 22, 23 and 24 are concerned. In the extract from pages 24 and 25 we have the express assertion of complainant's counsel that claims 22, 23 and 24 covered a combination of two elements, one of which was the specific sound record the product of a specific method of recording. Such sound record is not used by the defendants in the case at bar. In the extract from pages 48, 49 and 50 it again appears that the counsel for complainants in Leeds case asked for no broader construction of these claims, 22, 23 and 24, than that above referred to, including their specific wax record with its engraved groove. But the Court in deciding the Leeds case sustained claims 19, 20 and 21 which read for the reproducer, only in so far as they define a reproducer used in combination with the record of claims 22 and 24. This is clear from the language used by Judge GROSCUP in the decree in the Amet case, which was adopted by Judge SHIPMAN in writing his opinion in the Leeds case. This we have quoted above. On what theory then these complainants, having contended for and obtained a decision on claim 22, for instance, on the supposition that it covered no more than an engraved record, can now come into this Court and urge that this claim 22 covers a hard plate with an *impressed* or *indented* record, and, what is also necessary, that Judge SHIPMAN so held, these defendants do not understand.

The extracts which we have made from the decisions and complainants brief in the Leeds case and the comments which we appended to the extracts fully and conclusively prove that so far as the Bell & Tainter Patent No. 341,214 has been in litigation up to the present time and so far as the claims thereof have received judicial construction, the greatest breadth which has been given to them has been to hold as tributary thereto, first, wax or wax-like tablets or cylinders, with record grooves cut or engraved thereon, which grooves have sloping walls and have the sound undulations at the bottoms of the grooves, and, second, the combination of such same wax or wax-like record with grooves of the character pointed out with the reproducing stylus having a flexible mounting of a character pointed out with the reproducing stylus having a flexible mounting of a character to enable the stylus to automatically adjust itself within the width of a single groove along the sloping walls of the groove to automatically find the bottom of the groove, and be held against the bottom by yielding pressure. It cannot be seriously argued that the claims of the Bell & Tainter Patent have ever been given a construction broader than that here indicated.

But such construction very clearly throws out the defendant's machine as an infringement of the complainant's claims; because the defendants use no wax-like record, but a hard-rubber record so hard that it can hardly be cut with a knife and can certainly not be cut with a recording style; because they use no engraved groove and no groove with sloping walls of the character required; and no record at the bottom of the groove. Furthermore, the defendants use no combination of such a record and a reproducer in which there is an adjustment of the style laterally within the width of a single groove, or in which there is an automatic falling into one of two adjacent grooves from the ridge between the grooves, or in which there is a yielding pressure against the record.

Now, it is a well-settled principle of law that, on a motion for a preliminary injunction, the claims of complainant's patent may receive a construction no broader than that of the decisions adjudicating the patent. A recognition of this principle is manifestly fatal to complainant's motion. We therefore dwell briefly upon it.

In the case of Carey vs. Miller (34 Fed. Rep., p. 392), a patent for the method of tempering furniture springs was involved. This patent had been repeatedly sustained and held to cover a process in which the springs, during tempering, were kept below red heat. Judge LACOMBE, in dismissing the motion for a preliminary injunction, in speaking of the patent, said:

> "It may be sufficiently broad to cover any degree of heat whatever, but that has not as yet been held by the Courts which have had it under consideration. Therefore, upon application for a preliminary injunction, the patent will be presumed valid only to the extent expressly covered by the decisions referred to."

So, in the Consolidating Safety Valve Company vs. Ashton (26 Fed. Rep., 319, COLT, J.), the Court, had before it a patent which had been sustained by the Supreme Court, but as there was a doubt whether the alleged infringing device came within the scope of the patent, as construed by the Supreme Court, a preliminary injunction was refused.

So, too, we may extract from the case of the National Hat Pouncing Machine Co. vs. Hedden (29 Fed. Rep., 147), as follows:

> "It has been held to be 'well settled that, even after the validity of a patent has been established in a suit, and notwithstanding the presumption thereby raised that the patent is valid, it may always be shown in another suit on the patent against another defendant, and even in answer to an application for a preliminary injunction in such suit, *that the right claimed by the plaintiff in the new suit was not, either as to its nature or its extent, fairly in controversy in the former suit*, or that material facts were not known or considered when the former suit was tried, or that there are relevant matters which were not adjudicated in the former suit.' (Page vs. Holmes Burglar Alarm Tel. Co., 2 Fed. Rep., 336)."

In closing this section of the brief then, we beg to insist on the well-settled principle of law which declares that on a motion for a preliminary injunction the complainant must be satisfied with the broadest construction of his claims which the Courts have previously given thereto, and that he may not go beyond such broadest construction. But the broadest construction which the Courts have given to the Bell and Tainter claims limit them to a sound record of wax-like material having a groove of peculiar shape, with the record at its bottom, either alone or in combination with a mounting for the reproducing stylus, which effects the peculiar function of permitting an automatic lateral adjustment of the stylus within a groove and of an automatic yielding pressure against the record in the bottom of the groove. The defendants' device, however, has no record of the character required. This, in itself, disposes of the matter. Besides the mounting for the reproducing stylus does not effect the functions required. For these reasons we submit the motion should be denied.

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UNITED STATES CIRCUIT COURT,
FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY, Complainant,
vs.
THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMANN.
} In Equity

DEFENDANT'S BRIEF ON MOTION FOR PRELIMINARY INJUNCTION.
BY MR. GUSTAV BISSING.
(Continued)

Section 2.

We are now in a position to ask upon what theory the complainants hope to succeed with their motion for preliminary injunction. The answer is plain. The complainants have lost sight of the principle of law to which we called attention at the close of the last section of our brief. The affiants of complainants, in fact, take substantially this position. They say, here are certain claims, six in number, which Judge SHIPMAN has sustained. These claims, when broadly construed are, they assert, broad enough to cover the Berliner Gramophone. Therefore they say the Gramophone is an infringement of the Bell and Tainter Patent.

The answer to this contention is that all this might be very well at final hearing, at which the complainants are, perhaps, not barred from trying to obtain a broader construction of their claims than any they have heretofore succeeded in obtaining, provided they can succeed in so doing against the defendants' opposition and in view of all that **the defendants may show as to the state of the art. But for the** present purpose, we again insist that **the only construction of their claims which the complainants are entitled to assume is that given to them by Judges SHIPMAN and GROSCUP, and under such construction it is clear beyond the shadow of a doubt that the defendants do not infringe.**

Without taking up the affidavits of the complainants' experts *seriatim* and without analyzing their various statements, point by point, we may say in brief that they attempt to establish the following facts: first, that the groove of the Berliner Gramophone record is V-shaped and that the stylus is laterally adjusted therewithin; second, that the stylus of the Berliner Gramophone bears with a yielding pressure against the record; and, third, that the lateral motion of the mounting of the stylus in the Gramophone permits of its adjustment against any lateral inequalities which might be due to a departure from a truly mathematical construction of the machine, and that the vertical motion of the mounting for the reproducing stylus for the Gramophone permits of an adjustment for the warping of the hard-rubber record plates, in case they should not be rotating in a mathematical plane.

Now, as to the first of these alleged facts we beg again to say that the Berliner Gramophone record has no V-shaped grooves, and certainly no V-shaped grooves in the sense in which this word would have to be used as applied to the Bell & Tainter Graphophone. The form of the Gramophone grooves in cross-section is U-shaped, if anything, having very steep walls, which cannot be called sloping walls in any functional sense; furthermore, these grooves are so narrow and their sides so precipitous that there is no question of adjusting the stylus laterally within the groove, but simply a question of letting the stylus drop into the place it belongs, which is one place and only one place. We cannot insist too frequently that the cup-shape or pit-shape character of the cross-section of the Gramophone grooves and the corresponding shape of the stylus and the steep walls of the grooves make it impossible to talk of any lateral adjustment of the stylus within a groove. It would be just as possible for a man to talk about automatically adjusting an apple to his side coat pocket when he dropped the apple into his pocket. On the other hand, there is a very definite meaning when we talk about the adjustment of the Graphophone stylus within the Graphophone groove, for here, if we have not V-shaped groove, we yet have a groove with two straight sides meeting at a very obtuse angle, the side walls being, in consequence, of an exceedingly gentle slope, so that the Graphophone stylus has many places at which the friction will hold it at rest, unless it be tapped or jarred by the movement of the cylinder so that gravity will carry it down to the bottom of the groove. There is no place on the steep side walls of the Gramophone record where friction could have any effect in holding the stylus in place.

Going to the second alleged fact—the alleged yielding pressure of the Gramophone stylus against the record—we need only say that since the record in the Gramophone is found on the side walls of the grooves, and since the weight of the mounting is carried by the point of the stylus resting in the bottom of the groove, which bottom is even and not undulating, that there is no pressure exerted between the side walls of the record groove and the side faces of the stylus—that is, no pressure between the stylus and the actual record. The only way this could be brought about would be by using a blunt-pointed stylus which did not loosely fit the record groove, but which jammed therein. Just in so far as this is done, however, just in so far will Gramophone sound reproduction be prevented. The conditions in the Gramophone—those which are aimed at and those which are obtained with substantial perfection in the machines on the market—are conditions in which there is no pressure between that portion of the stylus which is in touch with the laterally undulating record and the laterally undulating record itself. There is no difficulty in attaining this result, in practice, because it is merely necessary to have a stylus which shall loosely fit the record groove. This condition being obtained, the stylus is vibrated by the side walls of the record groove in exact accordance with the undulations on these side walls, positively in both

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directions. There is, under such conditions, no departure from a true correspondence between the undulations on the record and the motion of the stylus which would be caused if the friction due to an initial pressure between the sides of the stylus and the side walls of the record groove had to be overcome. In other words, the very feature which it is aimed to remove and which is removed in the Gramophone reproducer, namely, the initial pressure between the undulating record and the stylus is the feature which is absolutely necessary for the operation of the Graphophone in which the stylus rests by yielding gravity pressure against the undulating bottom of the record groove, and in which sound is reproduced by reason of this pressure. This initial pressure or gravity pressure between stylus and record, which is absent in the Gramophone, is the point of the Graphophone which, in combination with the wax-like record, is covered in the complainant's claims now under consideration, for they state, for instance, that there is a "rubbing" style employed, meaning a style which has an initial frictional pressure against the record.

As to the third alleged fact, we may merely say that if the Gramophone reproducer of Berliner utilizes the lateral and vertical adjustment of the mounting for its reproducer arm to overcome or to adjust for any departure from a strictly mathematical construction of the various parts of the reproducing machines, such, for instance, as a warping in the plate, that we know of no claim of Bell & Tainter which can prevent this. *The idea of using a lost motion device for overcoming departures from an exact mathematical construction of machinery is so old and common in the art that no one can obtain a monopoly for its use.* It is one thing to say that Bell & Tainter have a claim which covers a flexible or lost motion mounting for a stylus, which co-operates in an especial way with an especial shape of the sound record groove for a definite purpose to adjust the stylus automatically to the bottom of the groove, and it is an entirely different thing to say that these patentees have a claim that will prevent builders of sound reproducing machinery from employing a lost motion device, not to effect this specific purpose but to effect the ordinary and old purpose of lost motion devices, namely, to overcome departures from exact mathematical constructions inherit in commercial machines. One thing is certain, Bell & Tainter have never yet established their right to such a claim in any Court, and if they should attempt to establish such a claim in the present suit at final hearing, they will find that they will have to overcome a prior art very different to that they have heretofore had to overcome in establishing their claims to their peculiar. kind of a lost motion connection for effecting the peculiar adjustment repeatedly pointed out, when used in combination with their peculiar shaped record grooves. We maintain that their claims are not capable of such broad construction. We protest against assuming in advance that they will succeed in establishing any such broad construction for their claims. We insist that they have as yet established no such construction for their claims, and we urge that it is absurd to suppose that they can do so. Should they succeed in so doing, it will be time enough to consider whether the lost motion of the Berliner reproducer effects the functions of permitting an adjustment against the warping of the plates, or against a non-mathematical character of the pitch of the thread. The experiments to which Mr. Lyons and Mr. Berliner have both testified, conclusively show that a lost motion connection for such purpose is unnecessary in the Gramophone art. Whether it is employed or not in commercial machines we need not now consider, because these complainants have no claims for such features, have never established their right to such features, and we insist never will establish their right to a monopoly of such functions.

Although it is not necessary, for the purpose of this present motion, to discuss the question of the infringement of claims 19 to 23 as they read on their face, and disregarding the decisions of Judges GROSCUP and SHIPMAN, we may briefly point out that the Gramophone does not infringe claim 19, because the style does not adjust itself automatically to the sound record. It is placed in the sound record where it belongs, and there is no adjustment after that. Of claim 20, we may make the same remark. Of claim 21, we may say that the reproducer is not held against the record, being the undulating lines at the side walls of the groove, by yielding pressure. Of claim 22, we may make the same remark made for claims 19 and 20, and further say that we employ no rubbing style, for our style has no initial frictional pressure against the record by which it could rub. As to claim 23, we may say that we employ no sloping walls in the sense in which these words are used in the Gramophone construction, and we have no style which "rubs" over the record. So that, even if we disregard the prior decision of Judges GROSCUP and SHIPMAN, and give to claims 19 to 23 of complainant's patent a construction as broad as is contended for, we find that defendant's device does not infringe complainant's claims.

In this connection we may refer to the testimony of Mr. Arthur S. Browne, who acted as complainant's expert in the Leeds case. In answer to x-Q 103, quoted in Brownell's affidavit, Mr. Browne testified that not all joints having a motion in two directions at right angles to each other were to be considered as the universal joint of Bell & Tainter, but only such joints as had these movements "in such a fashion as to perform the offices set forth in the patent." It is manifest, however, that the Berliner joint does not have the offices set forth in the Bell & Tainter Patent, as we have abundantly shown.

But there is another peg on which the affidavits filed in complainant's behalf seek to hang a reason for granting a preliminary injunction at this time against these defendants. Briefly stated, it amounts to this; that the reproducing machine which Judge SHIPMAN had before him was one in which the stylus was carried at the end of a glass tube, which glass tube was mounted in a universal fashion, so as to be free to rise and fall, being held down by spring pressure, and being propelled from the convolutions of the groove at one end of the record to the convolutions of the groove at the other end of the record by the convolutions themselves and without any other gearing or screw mechanism. The argument, then, is that as the Berliner Gramophone employs a similar mounting for its stylus the Gramophone must be considered an infringement of complainant's rights, since the Ecophone was so considered.

The argument falls to pieces when we bear in mind the fact that the Ecophone uses a wax cylinder precisely like that described in the Bell & Tainter patent, and in fact the very same wax cylinder that is sold on the market by these complainants, with very broad and very shallow record grooves, having sound undulations at the bottom of the grooves. When then the stylus of the Ecophone rests on one of these grooves, its vertical motion effects the function which is effected in the Bell & Tainter Patent, of pressing with a yielding pressure against the undulating record in the bottom of the grooves. So, too, when the Ecophone stylus rests on the record groove of the Bell & Tainter wax cylinder, its capacity for lateral adjustment permits it to slide down the gently sloping walls of the record groove to reach the bottom of the record. That is to say, the stylus, by reason of the lateral adjustment of its mounting, is permitted to laterally adjust itself within the space or width of a single groove. Manifestly, then, there is no escape from the conclusion that the Ecophone stylus mounting, when used in connection with the wax cylinder of the Bell & Tainter Graphophone, constitutes an infringement of the Graphophone construction.

But let us examine what would happen if we were to use the stylus and mounting of the Ecophone on the hard rubber Gramophone record of Berliner. It is plain at once that the vertical adjustment and spring pressure would no longer have the function of pressing the stylus in a yielding manner against the undulating record; for, since the stylus would substantially fit the cup-shaped record groove of the Gramophone tablet, there would be no initial pressure between the side walls of the stylus and the undulating side walls of the record grooves, which constitute the record. So, also, since the Ecophone stylus, when used in connection with a Gramophone tablet, would cooperate with cup-shaped grooves with steep side walls into which it fits, there could be no question of a lateral adjustment within the width of a single groove. The stylus would be put at the single and only place in the groove where it belongs. Nor would there in such case be any possibility of automatically selecting one or other of two adjacent grooves, for if the Ecophone stylus, when used on a Gramophone tablet, got on the ridge between two adjacent grooves, it would stay there. No amount of tapping could dislodge it.

In fact, this whole subject of lateral adjustment within the space of a single groove, or within the space of two adjacent grooves, is well illustrated by the fact that it is never necessary to tap the Gramophone reproducing machine, and it is frequently necessary to tap the Graphophone machine. The Ecophone stylus used on a Gramophone tablet would never need tapping. Such a thing as tapping a Gramophone record is unheard of. Such a thing, however, as tapping a Graphophone record is common practice and part of the instructions given to the purchaser of Graphophone machines.

From the fact, then, that Judge SHIPMAN found the Ecophone mounting and stylus, when used in connection with the peculiar record grooves of the Bell & Tainter wax cylinder, an infringement of the Bell & Tainter Patent, it by no means follows that he would so have considered the combination of this Ecophone stylus and mounting when used with a Gramophone tablet. Indeed, when the facts are considered, it is quite certain that he would have held to the contrary.

In this connection we may point out that the Ecophone is a mongrel or hybrid device, being in fact in some respects like the Graphophone and in other respects like the Gramophone. In so far as this Ecophone utilizes the idea of dispensing with all screws and gears, and of having the record itself do the work of *propelling* the stylus, it is an infringement of Berliner's invention as covered by claim 5 of his patent No. 531,543, before referred to. In other words, the Ecophone comprises within itself two inventions, the one being it capacity for carrying out certain ideas of Bell & Tainter, the other being its capacity for executin the ideas of Berliner. The only invention or function or capacity which Judge SHIPMAN had in min were those which belong to the Bell & Tainter sid of the device. He did not have before him thos functions which belong to the Berliner side of th device, for these were never raised, and, therefore never considered or decided. Neither was it necessary to decide them so long as the Ecophone stylu carrying arm was used in connection with Bell & Tainter's wax cylinder.

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UNITED STATES CIRCUIT COURT,

FOR THE SOUTHERN DISTRICT OF NEW YORK.

AMERICAN GRAPHOPHONE COMPANY, Complainant, vs. THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMANN.	In Equity

DEFENDANT'S BRIEF ON MOTION FOR PRELIMINARY INJUNCTION.

BY MR. GUSTAV BISSING.

(Concluded)

But we must here point out that, although the Echophone happens to have features capable of being used either with a Gramophone tablet and other features capable of being used with a Graphophone cylinder, that this double adaptability is by no means true, either of the reproducer construction actually used in the Gramophone or of the reproducer construction used in the Graphophone. That is to say, it is not possible to take the mounting for the diaphragm and stylus of the Graphophone and use it efficiently on the Gramophone. Neither is it possible to take the diaphragm and stylus mounting from the Gramophone and use the same efficiently on the Graphophone. The reason for this lies in the fact that both the Gramophone and the Graphophone use a diaphragm to increase the volume of sound. In the Graphophone the diaphragm must be perpendicular to the stylus, and, therefore, parallel to the surface of the wax cylinders. This follows from the fact that the record is in the bottom of the record groove. In the Gramophone the diaphragm is parallel to the stylus and is perpendicular to the surface of the hard-rubber tablet. This is necessary by reason of the fact that the sound undulations in the Gramophone are found in the side walls of the record groove. If, then, the Graphophone mounting were used on the Gramophone tablet, the lateral undulations which would be imparted to the stylus would tend to move the diaphragm in its own plane, and not perpendicular to this plane, as it ought to do in order that the diaphragm may operate efficiently. If, however, the Gramophone diaphragm and stylus were used on the Graphophone wax cylinder, then again the movements of the stylus imparted to it by the bottom of the record groove would tend to move the diaphragm in its own plane, and not perpendicular thereto. We see, then, that the presence of the diaphragm makes it impossible to use the Gramophone reproducer with the Graphophone tablet or the Graphophone reproducer with the Gramophone tablet. In the Ecophone this diaphragm has been omitted, and, therefore, the Ecophone has the dual adaptability of being usable either with a Gramophone tablet or with a Graphophone wax cylinder. But we repeat that, when the Ecophone reproducer is used on a Gramophone tablet, it has no function of laterally adjusting itself within a single groove, or of automatically selecting between two adjacent grooves, and no function of automatically pressing against the undulating record.

How utterly impossible it would be for Bell & Tainter to draw a claim, much less to sustain it, which should cover the swinging arm of Berliner's Gramophone when used in connection with his hard rubber record tablet abundantly appears from Figs. 1 and 2 of Edison's English Patent, A. D. 1878, No. 1644, which is explained in the Lyons affidavit. These figures were not referred to in Judge SHIPMAN'S decision. Here we have a swinging arm carrying the stylus of just such shape, length and relation to the flat record tablet as is found in the Gramophone. The first point which the complainants may urge against the reference is that, by reason of the inner spiral 3, the stylus may not adjust itself within the width of a single record groove. That is to say, while Edison has a mounting which carries the stylus across all the record grooves, the smooth inner spiral would prevent the lateral adjustment within the purview of a single groove. But Berliner does not adjust his stylus within a single record groove and he does carry it across a number of grooves. That is, so far as we are now concerned, Berliner does what Edison does and does not do what Bell & Tainter do. The second and last point which the complainants may urge against the Edison reference is that it does not disclose a gravity pressure of the stylus against the record. If so, the answer is that Berliner's Gramophone uses no gravity or other pressure between his stylus and record which is at the side walls of the groove. Besides the idea of having the reproducing stylus rest by yielding pressure against the record was old in the Cros article quoted in Brownell's affidavit.

In this second section of the brief, then, we have shown that the complainants, in this motion for a preliminary injunction, are not content with the construction of their claims which the Courts have heretofore given to them, but are attempting to set up a much broader construction than they have ever received by any Court. We have, furthermore, shown that, even under such broader construction, it is necessary to assume that Bell & Tainter have covered ideas which are old and common in the arts, such as a loose adjustment for its old and general purposes, and not for any purpose specific to sound reproduction, in order to even attempt to make out a case of infringement. We have further shown, by a brief examination of their claims, that Bell & Tainter have not even pretended to cover such broad and general ideas and functions, but that each of their claims is limited to some feature of construction or operation not found in the Gramophone. We have finally shown that the attempt to use the Ecophone construction as a basis for making out a case of infringement of the Gramophone structure is based upon a manifest misunderstanding of the facts.

SECTION 3.

But there is another ground—and one which rests on broader consideration than any specific question of infringement—which, as we contend, is fatal to complainants' motion for a preliminary injunction. This will appear from the following consideration.

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Mr. Berliner spent a number of years in his experiments for creating and perfecting his Gramophone. He made no secret of his operations, but as early as 1888 published an account of such results, as he had at that time, in a paper read before the Franklin Institute, a copy of which forms one of defendants' exhibits. Mr. Berliner, also, took out a number of United States Patents for his invention, of which these complainants must be presumed to have had knowledge. Copies thereof are attached to defendants affidavits.

Furthermore, before undertaking to launch the business of selling Gramophones on the market, Mr. Berliner, in order to discover whether his machine was an infringement of any existing patent rights, took his Gramophone to a gentleman of wide knowledge, skill and experience in the art of sound reproduction, and asked for his professional opinion on this question. The gentleman happened to be one who had been intimately connected with prosecuting the application for the Bell & Tainter patent in suit, and who is now the general counsel for the complainant corporation. The opinion which this gentleman gave was placed on very high ground, and was conclusive to the effect that the Gramophone infringed no existing patent rights, and, in particular, that it infringed no patent right of Bell & Tainter. Perusal of this extremely logical and lucid opinion convinced Mr. Berliner and all who claimed under him, as we believe it will convince this Court, of the correctness of the conclusion of non-infringement expressed in the opinion. A copy of the opinion is attached to Mr. Berliner's affidavit.

On the basis of that opinion, Mr. Berliner went ahead to organize a company and this company went ahead to build up a large business. As early as 1894, over a thousand Gramophone machines and over 25,000 Gramophone records had been sold openly and publicly and in direct competition with the machines of the Graphophone Company. That business has been constantly increasing and in this present year its extent is measured by over half a million of dollars, for Gramophone machines fill a want not filled by other sound reproducing machines, being particularly adapted and exclusively intended for amusement purposes. Their great volume of sound, their freedom from liability to injury or wear, makes them far superior to any other type of sound reproducing machinery for such purposes and this is well proved by the fact that the price of a Gramophone is still kept at twenty-five dollars, whereas other sound reproducing machines are sold as low as ten dollars, and yet the sale of Gramophone machinery is constantly increasing. All this is so fully pointed out in defendants' affidavits that we need not enlarge upon the matter here.

Now, what has been the course of these complainants in view of these operations of Mr. Berliner? Here was a machine sold in open competition with their machine, and known by them to operate on a different principle. Their own counsel knew that. Whether these differences are great or small, whether they are important or unimportant, no one can pretend that the American Graphophone Company and its agents not aware of the fact that the differences existed. No one can pretend that the American Graphophone Company did not know that before it could succeed in holding the Gramophone machine as an infringement of the Graphophone patent, the question of the materiality of these differences, be they great or small, between the Gramophone and the Graphophone, would have to be litigated, contested and adjudicated.

Did, then, these complainants bring their bill against these defendants during all these years in which the defendants' business has been growing up? Did they even notify by letter or otherwise any person or persons connected with these defendants that the operations of the defendants were considered an infringement of the plaintiffs' rights? The answer is no.

But what did these complainants do? The answer is simple. They brought suit against people who were using Graphophone machines, not against parties who were using Gramophone machines. They sued parties who were using machines built as closely as possible in imitation of the Graphophone. They sued people all of whom were using wax or wax-like cylinders with shallow sound grooves having the undulations in the bottom, and it was in a suit brought against such machines that they have obtained the decrees which they are now urging in the case at bar.

Broadly speaking, defendants have no quarrel with complainants on this account. The complainants may have done what was wisest and best to protect their interests by testing their patent rights upon machines which were constructed in direct infringement of their own, so as to make certain, in the first place, to sustain their patents upon any construction of their claims, however narrow. The second step, that of attempting to broaden the construction of their claims so as to reach a larger and larger range of infringing devices might follow later on. Complainants' course may perhaps have been a wise course and one which they had a lawful right to take.

But in taking this course they must not forget that there are questions to be litigated in the present cause which never have been litigated before; that they knew that such questions existed and were not in litigation in their former suits, and that their failure to attempt to litigate them during four years of active and public work on the part of defendants, resulting in the construction of a large business, would certainly deprive these complainants of the right to a preliminary injunction.

We understand perfectly, that the activity of complainants in bringing suits on their patents on devices which fall within the scope of their claims on a particular construction of them was sufficient diligence to entitle them to an injunction, at least on final hearing, against all future infringers who used the same device as those used by the prior infringers against whom suits had been brought, and which device also comes within the same scope of the claims. But we insist that just as soon as these complainants attempt to give to their claims a broader construction and one embracing devices not embraced by the narrow construction, which they alone were obliged to enforce in their prior suits, just so soon does their laches count against them when they attempt to enforce such broader construction. A claim narrowly construed and a claim broadly construed are, in law and effect, two different claims. In this aspect of the case these complainants have been suing on their narrow claims and they have failed for four years to bring and to prosecute to final hearing a suit on their broad claims, either against these defendants or any other defendants of whom we have knowledge, and this while the defendant's business was being publicly pushed and was rapidly growing. We urge with all possible force that such laches on the part of the complainant, in so far as any alleged broader aspect of their invention is concerned, if it have a broader aspect, *which we deny*, has absolutely and unquestionably barred their right to a preliminary injunction.

Defendants have been building up their business honestly and in good faith. It is a business based on patented inventions of Mr. Berliner. Much money has been spent, much ingenuity has been exercised, much capital invested, in constructing this business. Complainants during all this time have been silent. Instead of bringing suit against these defendants, or even notifying any of them or any one connected with them that they intended to bring such suit, they have been prosecuting their patent rights against infringers who have closely copied their machines and records. They have been testing questions not necessary to be tested in this suit, and they have utterly failed to test the questions which they will have to test before they can hope to hold these defendants as infringers. Their delay so attempting to test these questions, their delay in bringing suit against these defendants, knowing as they did that it would raise questions not raised in the suits which they were prosecuting, and their delay to even notify these defendants that the defendants' acts were considered as infringing, has forfeited their right to a preliminary injunction.

Aside from this question of delay in bringing suit, the preliminary injunction should not be granted for reasons well stated in the case of the Burleigh Rock Drill Company vs. Lobdell (7 O. G., 837.)

> "This is not a case of willful infringement, or of the use of a device identical with the patented one or a mere colorable attempt to evade it. The respondents are using a machine openly made and sold and used under patents, and which, in good faith, the manufacturers have placed in open competition with the machines made by the complainants, honestly believing that they were not trespassing upon any rights of the complainants. This is no defense if they are adjudged at the final hearing to infringe; but it is a reason why the Court should hesitate to interfere before the final decree in a case where there is no suggestion of any irremediable injury in the intervening time, or of any want of ability to respond to any judgment which may finally be recovered."

The case at bar is an exact parallel to that here quoted from.

There is another reason why a preliminary injunction should not be granted. It is that the injury which would be done to the defendants is far greater than any benefit which may come to complainants. The business of the defendant would be wiped out by a preliminary injunction. The only advantage which would accrue to the complainants would be, perhaps, after awhile, a slight increase in business by reason of an increase of their sales of Graphophones for amusement purposes. But it is well settled under such conditions preliminary injunctions do not issue (Swift vs. Jenks, 19 Fed. Rep., 641.)

But even machines thus sold could not adequately replace the Gramophone machines, as is abundantly clear from the affidavits, and there would thus be an injury to the public as well.

So, too, we insist that the proved financial responsibility of the several defendants and of the Berliner Gramophone Company which asks to be made a parry to the suit through the affidavit of its president Mr. Parvin, is a good reason why no preliminary injunction should be granted. In this connection we desire to state that the United States Gramophone Company, the owner of the Berliner Patents, also desires to become a party to this suit.

Again, whatever position the Court may take upon the question of infringement, whether the claims be construed more broadly than they have heretofore been construed by Judges SHIPMAN and GROSCUP, or whether they be confined to the scope given to them by these Judges, certainly it must be admitted that the very best position the complainants can make out leaves a doubt about the question of infringement. But such a doubt on the question of infringement in itself disposes of a motion for preliminary injunction. In this connection we need only refer to Robinson's well-known work on Patents, Section 1191, and the numerous decisions cited under Note 1.

Again it is well settled that if after a consideration of all the circumstances of the case, including not merely the technical questions of infringement, but all of the rights of the parties, the Court is in doubt whether or not to grant a preliminary injunction, such doubt should be resolved in favor of the defendants. Under this aspect of the case it is also clear that the motion should be denied.

It is, therefore, prayed that the motion may be dismissed.

All of which is respectfully submitted.

GUSTAV BISSING, Of Counsel.

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United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT:

THE AMERICAN GRAPHOPHONE COMPANY,
Complainant–Appellee,

v.

THE NATIONAL GRAMOPHONE COMPANY AND FRANK SEAMAN,
Defendants–Appellants.

APPELLANTS' BRIEF.

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Of Counsel.

WASHINGTON, D. C.:
Gibson Bros., Printers and Bookbinders.
1899.

FILED
JAN 5
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United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE AMERICAN GRAPHOPHONE COMPANY,
Complainant-Appellee,

vs.

THE NATIONAL GRAMOPHONE COMPANY and FRANK SEAMAN,
Defendants-Appellants.

Summary of Brief for Appellants.

The appellees have, in some form or other, sustained eleven claims of patent No. 341,214. In their motion, as filed, they allege infringement of five of these claims. Now they allege infringement of one claim only. This in itself shows that appellants are not copyists.

We premise that under the uniform practice of this Court, emphasized by a recent decision of the Supreme Court, justice must here be done in view of all the facts appearing in the record, according to this Hon. Court's own best judgment, and giving weight to the decisions of other courts only in so far as they commend themselves to the judgment of this Court.

Edison reproduced sound from a *tin-foil* record made by *indenting* sound undulations in a groove. The undulations varied *vertically*, the grooves had *sloping walls*, the sound undulations were efficient only at its *bottom*, and acted on the stylus *point*. He used a positive screw feed.

Bell and Tainter use a *wax-like* record made by *engraving* sound undulations in a groove. The undulations also vary *vertically*, the groove has *very faintly sloping walls*, the sound undulations are efficient only at its *bottom* and act on the stylus *point*. They also use a positive screw feed, and to adjust for imperfections in the mechanism, add *a tiny universal joint* for the stylus mounting, having a play not necessarily larger than one hundredth of an inch to **first** permit the stylus to *gravitate* to the *bottom of the groove where the efficient record is found;* **second,** to *center* and *thus track* the stylus within the groove by the *vertically downward pressure* of the mounting, which by driving the stylus down to the *bottom* of the groove keeps it at the center, the *side walls* of the record groove *not being steep enough* to restrain the stylus *by the lateral thrust*, and **third**, to keep the downwardly pressed stylus point in pressure-touch with the vertically varying record to have it in position at all times to reproduce sound.

Berliner entered a virgin field and developed the *laterally* undulating record superimposed on a groove of *even depth*, which he afterwards found had been suggested by *Cros*. He uses a *hard rubber* record in which the entire record is *impressed* at a single operation from a mold. The side walls of the groove are *very steep*. The sound undulations are efficient at *the upper edges only. There are no sound undulations at the bottom.* The *side* of the stylus is moved *laterally* and *positively in both directions* by the side walls.

Besides Berliner dispenses with the positive screw feed and uses instead a freely swinging arm, the stylus being propelled by the record. By dispensing with the feed screw he dispenses with the necessity of using the tiny universal joint. This is an important, distinct and patented invention of Berliner. The Berliner stylus fits within the record groove *at one place only*. It is *not automatically directed* to the most efficient place on the record. The Berliner stylus is tracked by the *lateral* thrust of the steep side walls which *embrace the stylus* and *not by vertically* downward pressure. *The stylus point is not in touch with or pressed against the record undulations.* The *side* of the stylus touches the undulations **without pressure,** *and the stylus may be moved up and down without interfering with reproduction.*

The echophone which was held to infringe claim 21 appropriated devices both of the Bell & Tainter graphophone and of the Berliner gramophone. *The only features of the ecophone considered by the prior adjudications were those of the graphophone including the wax cylinder with the engraved record.*

Judge Groscup's opinion in the Amet case *declined to hold claim 21 valid.* His decree required the parts defined in claim 21 to be used with the records defined in claims 22 and 24, in order to constitute an infringement of the patent. But claim 22 has been withdrawn by appellees and infringement of claim 24 has not been charged.

Judge Shipman's opinion declined to hold the reproducer of claim 21 patentable. His opinion concluded by requiring that Judge Groscup's decree should be followed, under which appellants would not infringe. **Judges Shipman and Groscup therefore both construed claim 21 narrowly.** *If the decree of Judge Shipman went further, it is of no moment here, because we must look to the opinion for the construction of the claim.*

It is an indisputable principle, abundantly fortified by authorities, that on motion for preliminary injunction a claim may not be given a construction broader than that of the adjudication sustaining it. It is also impossible to divorce the idea of the validity of a claim from the idea of its legal construction. *A claim broadly construed and a claim narrowly construed are as different in fact as if they had different numbers. The appellees have, therefore, only sustained a narrow claim. They now seek an injunction on a broad claim.*

The Court below sought to consider the naked question of the validity of claim 21, aside from its adjudication. It thus erred. *The Court below failed to notice that claim 21 covered at most a very narrow difference over Edison's English patent*, figures 1 and 2, and that if the record is not to be considered in claim 21, the claim defines no possible difference over Edison. Reading claim 21 in view of the patent specification instead of the adjudication, which in itself is error, the *Court* below *erred in reading* "*record*" in claim 21 *to mean* "*groove*." **The Court below mistook the facts when it held that the Berliner reproducer puts itself in place and keeps itself in place automatically like that of Bell & Tainter,** the fact being that *the Berliner stylus does not gravitate into place and keeps itself in place by a different action.* The Court below, furthermore, in spite of the prior art, the limitations of the patent specification, and the testimony of appellees' own expert, construed claim 21 for a broad and primary invention, having, in effect, no specific relation to the art of sound reproduction, and then attributed an erroneous function to the element of yielding pressure.

The Berliner invention was developed after years of experiments *on lines absolutely independent of* those of *Bell & Tainter and is equally fundamental with them.* Mr. Berliner launched his business in good faith *after an opinion written by Mr. Philip Mauro*, a recognized expert, *holding that the gramophone did not infringe* any existing patent right, and certainly not those of Bell & Tainter. That business in a few years had grown rapidly and now amounts to three-quarters of a million of dollars.

The appellees have sued copyists of their invention. They have sought to enforce their claims on a narrow construction only. Asserting now a broad construction for their claims they, in effect, assert different claims. Their laches in suing on these claims, broadly considered, has barred their right to a preliminary injunction against these appellants. The appellees never gave appellants notice that their operations were considered infringing in character.

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United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE AMERICAN GRAPHOPHONE COMPANY,
COMPLAINANT-APPELLEE,

vs.

THE NATIONAL GRAMOPHONE COMPANY AND FRANK SEAMAN,
DEFENDANTS-APPELLANTS.

APPELLANTS' BRIEF.

Section 1.

1. STATEMENT OF THE CASE.

This is an appeal from an order of the Court below granting a preliminary injunction, against the defendants-appellants, on claim 21 of the patent No. 341,214, issued on May 4, 1886, to Bell & Tainter, to which patent the complainant-appellee asserts title. The bill of complaint was filed on October 23, 1898. Thereupon, on November 11, 1898, complainant made a motion for the granting of a preliminary injunction on claims 19, 20, 21, 22 and 23 of the patent referred to, and in support of said motion filed a copy of the bill of complaint, certain affidavits and a copy of the patent in suit. Replying to these papers, the defendants on November 30, 1898, served copies of certain answering affidavits, including one by Mr. Berliner, and of certain patents upon the complainant. On the morning of December 2d, the day of the hearing in the Court below, the complainant filed an affidavit of Mr. Philip Mauro, as in rebuttal to the affidavit filed on defendants' behalf by Mr. Berliner. The complainant at the beginning of the hearing withdrew from consideration all claims except No. 21. The case was then argued and thereupon an opinion was rendered by the Court below holding that the complainant was entitled to a preliminary injunction, stating that it could take an order for such injunction upon formally withdrawing from its motion all claims except No. 21, and further stating that the operation of the order of injunction would be suspended until January 25, 1899, in order to give the defendants an opportunity to prosecute an appeal. Thereupon the complainant, on December 13, formally withdrew claims 19, 20, 22 and 23. An order for an injunction was then signed on December 15, 1898. An order temporarily suspending the injunctions was signed on December 16, 1898. This appeal is from the order granting the injunction.

Claim 21 reads as follows:

> "The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described."

II. Assignment of Errors.

1. The Court erred in granting a preliminary injunction.

2. The Court erred in that on motion for preliminary injunction it construed claim 21 in view of its own understanding of the specification of the patent instead of construing it in accordance with the prior adjudications.

3. The Court erred in giving claim 21 a construction broader than any which had been given to that claim in the adjudications sustaining the patent.

4. The Court erred in considering and deciding vital

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matters of differences of construction and mode of operation between complainant's patent and defendants' machine, on *ex parte* affidavits in a motion for a preliminary injunction, which matters were not involved in any prior case and have not been adjudicated.

5. The Court erred in not giving effect to the history of the invention of the patent in suit, being the Bell & Tainter graphophone, an improvement on the Edison phonograph, and the history of the invention of the defendants' machine, being the Berliner gramophone, an improvement on the sound recorder and reproducer of the Frenchman Cros, which histories of the two inventions create such a presumption that there is no interference, contact or overlap between the work of Bell & Tainter and of Berliner as to entitle the defendants to a full and final hearing.

6. The Court erred in disregarding the special equities of defendants, as set forth in defendants' affidavits.

7. The Court erred in holding that the complainant had not lost its right to a preliminary injunction by reason of its laches in failing to bring suit against or notifying the defendants that defendants' operations were considered an infringement of complainant's patent, which failure to sue or notify defendants extended over a period of four years, during which time defendants' business was growing up; and which failure to sue or notify the defendants was in spite of the fact, shown by defendants' affidavits, that complainant knew that the questions necessary to be decided to hold defendants as infringers of complainant's patent were not involved in the suits which complainant was prosecuting.

8. The Court erred in construing the word "record" as used in claim 21 to mean the groove upon which the record is formed, overlooking the fact that the specification and claims of the patent are each careful to distinguish between these terms, "groove" and "record," and the facts which they represent.

9. The Court erred in assuming that defendants could not show by a hearing upon full proofs that claim 21 is

a void and unpatentable claim, when construed so broadly as to cover a stylus pressing upon the flat floor of a groove and taking its vibrations positively from the side walls thereof.

10. The Court erred in holding with reference to claim 21 that "it would seem to make little difference whether the irregular or record surface was located at the bottom or at the side of the groove."

11. The Court erred in giving claim 21 a construction which makes its substantial subject-matter anticipated by Edison's English Patent, A. D. 1878, No. 1644, and also by Edison's United States Patent No. 200,521 of February 19, 1878.

III. Nature and Extent of the Review in this Court on Appeals from Orders Granting a Preliminary Injunction.

It will be well, at the outset, to refer to the authorities which define the nature of the review and the extent to which this Court examines into all the facts that are before it, in considering appeals from orders granting preliminary injunctions. There has been some diversity of opinion among the Courts of Appeals of the several circuits upon this question. The practice in this Circuit has, however, been uniform and in the direction of examining all the facts in the record before it and deciding the appeal according to the Court's own best judgment. Such practice was first defined in this Circuit in the case of the American Paper Pail and Box Company *v.* National Folding Box and Paper Company (2 C. C. A. 167; 51 Fed. 229), from which we quote as follows:

> "The appeal calls upon this Court to state its position as an appellate court in regard to motions of this character, and particularly with respect to the weight which is to be given to the previous adjudication, which is generally the foundation of a preliminary injunction. The appellate court is to examine the interlocutory decision of the circuit

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> court in the light of the affidavits and of the history of the patent and the adjudications thereon which were represented to that court. The adjudication upon which the motion for preliminary injunction was based not being the subject of the appeal, it is to have the same weight which it should have before the circuit court; but while the circuit court, upon a motion for an injunction, might deem itself constrained, contrary to its own judgment, to adopt the rulings of another circuit court upon questions of law made at final hearing, this court is at liberty to re-examine such rulings, dispose of the questions of law conformably to its own convictions, and accord to the former adjudications such weight as, in its own judgment, it was entitled to upon the motion."

The practice as thus outlined was next followed and endorsed by this Court in Curtis *v.* Overman Wheel Company (7 C. C. A. 493; 58 Fed. 784), from which it is unnecessary to quote.

In Thomson Houston Electric Company *v.* Hoosick Railway Company (27 C. C. A. 419; 82 Fed. 461) this Court again referred to the case of the American Paper Pail and Box Company, *supra*, quoted a portion of the extract from that decision which we have just given, and went on to reverse an order granting a preliminary injunction on the ground that the patent was invalid, such invalidity appearing on the face of the papers which were before the Court, and this notwithstanding the fact that the patent had been declared valid in the Circuit Court, in face of a similar defense.

It is quite clear, then, that this Court is not inclined to take any narrow view of its jurisdiction in questions of this kind, or to draw imaginary lines across the subject-matter of the order appealed from, and to hold that it has a right to examine the questions that arise on one side of such line, but must close its eyes to matters that lie on the other side, however vital such matters may be to a proper disposition of the appeal. The practice of this Court has strongly leaned in the direction of examining the entire record and of determining the propriety of granting an injunction, not in accordance with the particular and perhaps necessarily restricted point of view of the Judge below, but in accordance with this Court's own best judgment, in view of all the facts that are before it.

The correctness of such attitude on the part of this Court has recently been abundantly confirmed by the decision of the Supreme Court in Smith v. Vulcan Iron Works (165 U. S. 518), which decision has been elucidated and followed by the Circuit Court of Appeals in the seventh circuit, in the case of the Stover Manufacturing Company *v.* Mast, Foos & Co., (89 Fed. 333.) From the last case we quote as follows:

> "The decision touching the practice on appeals from interlocutory orders, under the judiciary act of 1891, have not been in entire harmony; but in the recent case of Smith *v.* Vulcan Iron Works, 165 U. S. 518, 17 Sup. Ct. 407, where the decisions touching the subject are collected, the Supreme Court has defined clearly the scope of the review which the act was intended to authorize. After declaring that the appeal, which by section 7 of the act may be taken from an 'interlocutory order or decree granting or continuing such injunction,' is an appeal 'from the whole of such interlocutory order or decree, and not from that part of it only which grants or continues an injunction,' *the Court proceeds to say that the manifest intention of the provision was 'not only to permit the defendant to obtain immediate relief from an injunction, the continuance of which throughout the progress of the cause might seriously affect his interest, but also to save both parties from the expense of further litigation, should the appellate court be of opinion that the plaintiff was not entitled to an injunction, because his bill had no equity to support it.' The comprehensive terms of this expression forbid the suggestion that it does not apply when the appeal is from an order made upon affidavits, and not from a decree ordering both an injunction and an accounting, entered as the result of a hearing upon full proofs. If there is ground for a distinction in that*

> *respect, it is in favor of the appeal from a preliminary order* made upon *ex parte* and imperfect showings at the commencement of litigation, rather than an appeal from an injunction perpetual in terms granted after a full hearing, which is called interlocutory only because there remains to be taken an accounting, upon which the evidence adduced cannot ordinarily affect the injunction. *This being the scope of the appeal, the logical inference would seem to be that every application to a circuit court for an injunction or temporary restraining order should be considered on its merits, and that a ruling or opinion of another court upon any question involved should be given only just and reasonable weight according to the circumstances. The statute gives the right of appeal: the Supreme Court has determined that the review, so far as may be, shall extend to the merits; and it is not consistent to say that the decision of an inferior court must be pronounced on one basis and reviewed on another.*"

And thereupon the Court of Appeals of the seventh circuit, upon the papers filed in support of a motion for a preliminary injunction, declared invalid the claim of a patent which the Circuit Court of Appeals of the eighth circuit had held valid upon full proof after final hearing.

These two decisions, supporting and extending as they do the uniform practice of this Court in cases of this kind, are conclusive to the effect that this Court may fully and freely investigate all the questions necessary to properly determine the points in issue, so far as they may be determined from the papers that are before the Court; that this Court may decide the matter according to its own untrammelled judgment and is not bound by prior decisions sustaining the patent, except in so far as they commend themselves to this Court's approval, and that this Court may not confine its deliberations to determining whether the discretion of the Court below has been properly exercised, but that it shall administer such full relief as equity demands.

It may be well to notice here that the complainant has conceded our right to a final hearing on all the claims of his patent except one. Some eleven claims of this patent have been sustained in some form. Five of these relate to the record itself, and the complainant never pretended that we infringe those claims. Six of the claims involve the reproducer. When the motion for preliminary injunction was first brought, the complainant urged that we infringed five of the claims. Before the hearing in the Court below, however, all but one of these claims was withdrawn. Conceding, therefore, our right to a final hearing on all claims but one, these complainants, in effect, concede our right to a rehearing along the whole line.

IV. The History of the Bell & Tainter Invention.

In order to properly understand the scope of claim 21 of the patent on which an injunction is asked (Record, p. 51), it will be necessary to consider, briefly, the improvement which this claim is designed to cover, and to do this we have to examine the prior art.

The well-known Edison phonograph (R. pp. 161 ; 205), is a machine designed for recording and for reproducing recorded sounds. By this machine sounds are recorded by uttering them against a vibrating diaphragm, and causing the resulting vibrations of the latter to be impressed as indentations upon a travelling sheet of tinfoil by a stylus carried by the diaphragm. The reproduction of the sounds, thus recorded, was ordinarily obtained by moving the tin-foil as before, and causing the indentations upon the same to actuate the diaphragm through the intermediary of the stylus, which was arranged to engage the indentations. The difficulty was that the material of the tin-foil was pliable, and that the indenting point bent the tin-foil down and around the point of contact and thus distorted the indentations. Nevertheless, we have in Edison a record adapted for reproducing sound, in which the record moves the sound-reproducing stylus in a direction per-

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pendicular to the face of the record, the undulations constituting the **record or inscription,** being formed in a groove, being most pronounced and of maximum efficiency at the very bottom of the groove, and dying out along the side walls of the groove as the bottom of the groove is receded from.

Bell & Tainter changed this device of Edison into the well-known graphophone. They did this by discarding the tin-foil and using instead a wax or wax-like material into which the record was engraved or cut by bodily removing chips of the substance of the material, as distinguished from the process of indentation used by Edison. The wax or wax-like material is, on the one hand, supposed to be soft enough not to offer any undue resistance to the engraving or cutting stylus in the act of recording sound, and is, on the other hand, considered by the inventors to be so hard that the record is not readily injured or readily worn out by the resproducing stylus, in the reproducing operation. The vibrations which are imparted to the reproducing stylus, in the reproducing operation, in the case of the sound record on the wax tablet or cylinder of Bell & Tainter, are in a direction perpendicular to the surface of the record material, just as in Edison. (Pollok & Mauro's opinion, R. p. 80.) So, too, the sound record on the wax tablet or cylinder of Bell & Tainter is found superimposed on a groove with sloping walls, the undulations being most pronounced and, in fact, efficient only at the very bottom of the groove, and dying out rapidly along the side walls thereof. Although the affidavits may speak of the record as at the bottom of the groove, this means the efficient record only. This point in fact was conceded by our opponents on the hearing below.

Now, the difference in the material used by Bell and Tainter, wax as against tin-foil, and the difference in the method of cutting the record as distinguished from indenting it, have been held, so far as the question has yet been litigated, to have created such an advance in the art as to entitle the wax tablet or cylinder of Bell and

Tainter, carrying their engraved sound record, to be regarded as a useful invention. As such it has been sustained by Judge Grosсup in the case of the American Graphophone Company *v.* Amet (74 Fed. 789), by Judge Shipman in the case of the American Graphophone Company *v.* Leeds (87 Fed. 873), and by Judge Wheeler in the case of the American Graphophone Company *v.* Walcutt (87 Fed. 551). This is the first feature claimed as an invention by Bell and Tainter, *and no one pretends that it is used by defendants.*

The remainder of this portion of the brief will be devoted to a consideration of a second feature claimed as patentable by Bell and Tainter. This is a combination of the peculiar record above described with a flexibly mounted and yieldingly pressed stylus. To properly appreciate the scope and importance of this combination, it will be necessary to see what capacities or capabilities the flexible mounting has in the combination. The principal capabilities or capacities of the flexible mounting in this combination are three in number. The first of these we shall now seek to explain.

To this end, it is necessary to carefully consider the kind of groove of Bell & Tainter's wax cylinder, as manufactured by the complainant-appellee. A photograph of such grooves, on a scale thirty times enlarged, obtained by a process of micro-photography, is found on page 146 of the record, and is marked "Chapman Micro-photograph, Graphophone Grooves." The reason that the commercial wax cylinder has been used to obtain this photograph, instead of going to the patent, is due to the fact that the drawings of the patent (R. p. 41) show the cutting style apparently drawn to scale, and as only the extreme point of the style is used, for a distance of, perhaps, one five-hundredth of an inch, it is plain that the shape of that part of the stylus which does the actual work of cutting, the extreme point, cannot be

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ascertained from the drawing alone. The specification of the patent, in speaking of the shape of the cutting stylus, (R. p. 47, l. 68) refers to the fact that the extremity is rounded, but does not indicate the extent to which the rounding is carried. It is manifestly better, in view of this uncertainty, to go to the actual device which the complainant constructs under his patent.

Careful examination of the Chapman photograph (R. p. 146) will disclose an undulating line at the bottom of the white half-circle in the picture. But the stylus is not to be thought of as moving in the plane of the paper across these undulations in the operation of reproducing sound. On the contrary, this photograph, it is to be understood, shows the appearance of the grooves of the graphophone wax cylinder as they appear in cross-section, not in the direction of the length of the groove, but across a number of consecutive grooves at right angles thereto, and in a direction parallel to the axis of the cylinder, so that the stylus must be imagined as moving perpendicular to the plane of the photograph, and not in that plane.

The photograph shows that the graphophone grooves are exceedingly shallow and broad in comparison with their depth. The reason for this lies in the fact that with the method of *cutting* the record it is necessary to have a very shallow record in order that there may not be too much resistance to the cutting style. The surface of the record material is merely skimmed off. The photograph furthermore shows that there are ridges between the grooves, about as well defined as the grooves themselves, the sides of two adjacent grooves, in fact, coalescing into a more or less sharply defined ridge. An examination of the small, flat, rectangular model of wood having three rows of undulations upon it and marked No. 1 on the back, which has been filed as an exhibit in this cause, will readily make this matter plain, especially if attention is given to the penciled arrows marking the course of the stylus.

Now let us examine such a record, superimposed on a wide and shallow groove of the shape shown in the photograph, with the undulations efficient only at the bottom or center of the groove, and carried in a tablet or cylinder of wax or other recording material. It is manifestly necessary, in order that the stylus shall travel over the entire record, that some apparatus be provided by which the record tablet and the stylus are moved with relation to the other. The means which the prior art provided (Edison patents) was a positive gear or screw feed which carried the rigidly mounted stylus across the record tablet or cylinder, while the tablet or cylinder was turning on its own axis, thus successively bringing each portion of the record in operative relation with the point of the stylus. But with the wide and shallow grooves of Bell & Tainter, which are shown in the photograph, and in which the undulations constituting the record are efficient only at the very bottom or center of the groove, and are evanescent and inefficient along the side walls of the groove, it may be undesirable to so construct the machine as to have the stylus, by positive mechanism, at all times touch the precise portion of the groove where the record is sufficiently efficient, this being in fact the very bottom or mathematical center of the groove.

The combination claimed by Bell & Tainter, embodying as it does a flexibly mounted stylus, permits the stylus, when placed within the purview of a record groove, to gravitate down the sloping side walls to the bottom of the groove, where the most efficient record is found. Besides, if the stylus happens to be placed upon a ridge between two adjacent grooves, it may automatically select and slide down into one or other of these grooves. This capability or function of the combination of a flexibly mounted stylus with the peculiar record of Bell & Tainter, which combination has been referred to above as the second feature of their invention, is one on which much stress is laid in the patent, as will presently appear.

As the graphophone wax cylinder, in ordinary practice, has about one hundred helical turns of the record

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groove to the inch (R. p. 133, ¶ 37), it will be seen, in order that the stylus may be able to effect the function which we have just described, of automatically gravitating to the bottom or center of a preselected groove, when the stylus is resting on the side walls of the groove, or of falling into one of two adjacent grooves when the stylus is placed on the ridge between the grooves, that the amount of necessary lateral play is exceedingly slight, being at most one one-hundredth of an inch, though in the commercial construction it may be a trifle more than this, and that the amount of necessary vertical play is very much smaller than this. In the patent No. 341,214, this play is shown as effected by a small bit of rubber tubing, numbered 32, and well shown in Fig. 8 (R. p. 41).

That we have correctly stated one function of the lateral and vertical adjustment of the mounting for the stylus appears on page 4, l. 62, of the patent in suit (R. p. 48) from which we quote as follows:

> "No special care is necessary to insure its adjustment (meaning the reproducer), for if the reproducer K be allowed to rest against the record with the style upon the engraved line, the style will of itself gravitate to the *bottom of the groove.*
>
> "There exists always a liability to disarrangement in some part of the machine either in the recorder or the support therefor or the recording tablet or its support, or if there be no disarrangement it would be difficult to insure that the reproducing style should touch *the record precisely at the proper point* if the reproducer be held rigidly. Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the *style automatically adjusting itself to the proper place on the record.*"

The proper "point" or "place" on the record which the reproducing style is required to touch, by the extract from the patent which we have just quoted, is that portion of the record which is found at the bottom or center of the groove, as distinguished from the inefficient and vanishing record that is found along the side walls of the groove.

The groove carrying the record is, as we have repeatedly said, very shallow and broad in comparison. It is manifest, therefore, as indicated above, that the vertical play in the mounting for the reproducing stylus is not brought into action to the same extent as is the lateral play. The patent, in speaking of this matter, therefore, goes on to say (R. p. 48, l. 79):

> "It will be seen that the reproducer is mounted on a universal joint, so that it can move in any direction. The movement parallel with the face of the tablet would, however, by itself allow the style to follow and adjust itself to the record to a useful extent."

This completes our discussion of the first capability or function of the combination of the peculiar wax record and flexibly-mounted stylus claimed as Bell & Tainter's invention.

In addition to the capability for the flexible stylus mounting used in connection with the broad and shallow record groove, in which the efficient record is at the center or the bottom of the groove, which we have above set out, there is a second utility in this combination. This appears when we consider the shape of the groove in cross-section as shown, for instance, in the Chapman photograph (R. p. 146), which shows that the side walls are so very gently inclined that they would not of themselves act to restrain the course of or to track the stylus. In order to track a stylus by the lateral thrust merely of the side walls of the groove, it is clearly necessary that the side walls should be rather steep and well pronounced so as to embrace the opposite sides of the stylus. The record groove shown in the photograph, which represents the record groove of the complainant-appellee, has no side walls of this character. If the stylus is guided by the groove, it is not done in the ordinary way by the lateral action of the side walls.

The patentees therefore rely on another principle to track their stylus in their groove. They rely on the vertically-yielding pressure of the stylus against the groove, which pressure will necessarily tend to force the stylus down to the bottom of the groove; and since this is, at the same time, the center of the groove, the stylus will be kept within the groove. If the stylus at any time tends to get out of the groove by sliding up a side wall, the yielding pressure acting downward tends to drive the stylus point back toward the bottom and, therefore, toward the center of the groove. That is to say, the stylus in the graphophone construction is guided and kept in the groove not by the lateral thrust of side walls, but by the vertical, downward pressure which secures an automatic centering within the groove, which is, at the same time, the bottom of the groove. This is the second capability or function of the Bell & Tainter combination.

In addition to the two capabilities of the loose mounting above set forth, we may now refer to a third capability which the flexibility of the stylus mounting has, when used in connection with the kind of groove shown by Bell & Tainter and by Edison, in which the undulations vibrate the stylus in the direction of its length, by acting on the *point* of the stylus only.

It would be unprofitable and in fact impossible to go into the details with that refined and ultimate geometrical analysis which alone could place the matter upon an impregnable mathematical basis, for such an investigation can only be made by means of expert testimony of the highest order, and can only be sifted by the most rigid of cross-examinations. We are dealing here with quantities that are exceedingly minute. Whatever of patentable substance there may be in the devices in controversy, depends upon differences in construction over the prior art which it requires a microscope to examine and a mathematical sense to appreciate. Nevertheless, unless the subject is examined in this minute way, by a microscope as it were, no proper appreciation can be had either of the alleged merit of complainant's patent, or of the construction or mode of operation of defendant's device.

We may, however, without undue refinement of analysis, say this much on the utility of the vertical flexibility of the complainant's stylus mounting, when used in connection with a form of record in which the undulations touch the *point* of the stylus only, and therefore, tend to vibrate the stylus in the direction of its length and perpendicular to the record surface. In such a form of record, it is manifestly necessary that the point of the stylus should positively touch each point of each sound undulations, from one end of the record to the other. If the stylus point, for any reason whatever, is, at any time, separated by a space however minute; one five hundredth of an inch or one millionth of an inch, from the undulations constituting the record, for just such time is sound reproduction impossible. The stylus point must touch under pressure each point of the undulating surface at all times. The slightest separation of these parts however minute, is fatal for sound reproduction. Bell & Tainter, therefore, by using a mounting for their stylus which has a flexibility in a vertical direction and which presses the point of the stylus with a yielding pressure against the undulations that constitute the record have insured that the stylus point and record shall at all times keep in absolute pressure touch.

We may here briefly summarize the three capacities or functions inhering in what we have called, the second feature of the invention claimed by Bell & Tainter, namely, in the combination of their wax tablet or cylinder, having a record of the form described, with a mounting having a play in a lateral and vertical direction for the reproducing stylus, made necessary by the positive screw gearing which they employ, and which play has an exceedingly minute compass. These capacities are such as to enable the style *first* to automatically fall into one of two adjacent grooves from the ridge between the grooves, or, when placed within

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the purview of a single groove, to gravitate down the very slightly inclined and rather wide side wall of the groove to the bottom of the groove, where the efficient sound record is found; *second*, to automatically guide or keep the stylus within the groove, not by the lateral action of the side walls, but by the automatic centering action of vertical pressure, and *third*, to keep the stylus *point* in pressure contact with the vertically undulating record.

The combination of the peculiar sound record of Bell & Tainter with the flexible or universal mounting for the reproducing stylus, which we have described, has been held patentable both by Judge Groscup and by Judge Shipman; and, so far as we are aware, these two features—the wax cylinder, with a cut or engraved record of the shape described *per se*, and the wax cylinder with a cut or engraved record of the shape described, in combination with the flexibly mounted stylus—are all that have been held patentable up to the present time to Bell & Tainter, by any United States Court. No case has arisen for deciding anything else.

V. HISTORY OF THE INVENTION OF THE BERLINER GRAMOPHONE; COMPARISON THEREOF WITH THE HISTORY OF THE BELL & TAINTER INVENTION, AND A COMPARISON OF THE TWO INVENTIONS THEMSELVES.

We may now turn to the work of Mr. Emile Berliner as embodied in the well-known gramophone, which the order appealed from (R. p. 217) holds as an infringement of claim 21 of the patent in suit.

Just as Bell and Tainter found the basic ideas of their invention in the Edison phonograph, and just as they adopted certain changes to make this type of phonograph successful, so Berliner found the basic ideas of his invention in the Scott phonautograph and later in the theories of the Frenchman Cros; and after years of experiment he hit upon plans which put the theoretical and commercial ideas of these earlier scientists into practical and commercial form.

The Scott phonautograph, which is well known to students of science, and is described in the Lyons affidavit (R. p. 121), in the Berliner Franklin Institute lecture (R.p. 175), and in Pollok & Mauro's opinion (R. p. 77), is a device for recording but not for reproducing speech. It consists of a membrane carrying a stylus, which bears against a rotating cylinder covered with lampblack. As the cylinder rotates, sounds are uttered in the vicinity of the diaphragm, and the diaphragm is set into vibration. By means of these vibrations the style removes the lampblack on the cylinder along an undulatory line. The action is precisely like that of writing with a stylus on a smoked-glass plate. The stylus does not move perpendicular to the surface carrying the lampblack, so as to make a groove of varying depth, but, we repeat, the style is moved laterally only, so as to make a laterally undulating line upon the surface of the cylinder, which accurately pictures the sound which has been uttered against the diaphragm.

The Frenchman Cros carried Scott's idea further, and attempted not only to record sound in the manner set out by Scott, but also to reproduce the sound thus recorded (Pollok & Mauro's opinion, R. p. 78). Without going here at large into the processes detailed by Cros, which are fully set out in the affidavit by Mr. Lyons (R. pp. 122, 123), it may be said that he suggested the inscription of the sound record along a laterally undulating line on the surface of a smoked plate, and then, by a process of photo-engraving, the making of a metal plate carrying in its face a groove of even depth, but with lateral undulations corresponding to the sound waves. From this groove of even depth, with the sound record on the side walls thereof, he proposed to reproduce the sound by a metal point held in the groove by a spring at one end, and made solid with the diaphragm at the other end (R. pp. 167, l. 18).

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That is to say, while the Edison phonograph had the sound record in the form of a groove with vertically undulating bottom, Cros' idea was to have the sound record along the sides of a groove, the bottom of which was entirely even. So, too, while Edison reproduced by moving a reproducing stylus perpendicular to the face of the record material, Cros proposed to reproduce by moving the stylus, held against the record by a spring, laterally in a direction parallel to the face of the record material. Now, Berliner, after four years of constant experiment, devoted to this subject alone, was enabled, without departing from the fundamental principle of Cros, to put his ideas into practical form, just as Bell and Tainter, after their experiments, succeeded in putting the ideas of Edison into better form, without departing from the fundamental principle of Edison (P. pp. 126, 127).

Berliner, although ignorant of Cros' work until after his own experiments had well progressed, effected this improvement on the Cros conception by using, as his original record plate, a zinc plate covered with a very thin fatty film, instead of using Cros' smoked-glass plate, which fatty film Berliner removes along a laterally undulating line of even depth by the recording stylus. After having removed the material of the fatty film along the laterally undulating line, the zinc plate is placed in an etching bath, and the material of the zinc plate is eaten out along a groove having undulations in a lateral direction, but having a uniform depth depending merely upon the time of the immersion of the zinc plate in the etching bath. When the groove has been etched to a sufficient depth, the zinc plate is removed from the etching bath and placed in an electro-plating bath, where it is electroplated with copper. The copper plate thus obtained has on its face, in a raised form, a ridge of even height, but with lateral undulations corresponding to the sound record. This copper plate is then used to impress the sound record into hard rubber plates, which have been temporarily softened by heat. One copper plate may thus be used to impress as many as a thousand rubber plates. Each rubber plate carries the sound record in the form of a spiral groove of even depth with lateral undulations corresponding to the original sound. (Pollok & Mauro's opinion, pp. 81, 82; Lyon's affid., pp. 127, 128.)

Such a hard rubber plate is one of the important inventions of Mr. Berliner and is covered by his patent No. 548,623, dated October 29, 1895 (R. p. 107). Its advantages are obvious. First of all, it carries a more accurate representation of the sound than any record tablet yet devised. This is due to the fact that there is no substantial resistance to the motion of the recording stylus in recording sound, for the fatty film on the zinc plate may be made almost infinitesimally thin, and what little resistance there is must be uniform. In the Bell & Tainter phonograph wax record, the wax offers considerable resistance to the recording stylus, for the groove must be of appreciable, though slight depth, in order to do good work in reproducing, and, besides, the resistance to the recording stylus varies with the depth of penetration, so that the sound record is distorted to this extent. Again, the rubber record is hard and indestructible, so much so that the impression by the copper plate must be effected when it has been softened by heat. It would be physically impossible to cut or engrave it with a stylus actuated by sound vibrations. Besides, Berliner's process has the capacity for unlimited multiplication of record plates in a cheap and simple manner; one pressure with the copper plate impressing the entire record of all the sounds. In the wax tablet, each record must be made separately by directly cutting the sound record upon it, sound by sound. Furthermore, since, in reproduction, the undulations constituting the record in Mr. Berliner's hard rubber plate touch the sides of the stylus and move the stylus positively in both directions, parallel to the face of the plate and not perpendicular thereto, the stylus need not and does not bear with any initial pressure against the undulations constituting the record. In the Bell & Tainter record, the undulations at the bottom of the groove touching the *point* of the stylus, vibrate the stylus in a direction perpendicular to the face of the record tablet, *which requires an initial pressure between the reproducing stylus and the record in order to reproduce the record in the form of sound or speech.*

But there is another feature of Mr. Berliner's invention in which he improves on Cros, who, like Edison, employed a positive gear feed, and that is the combination of the peculiar hard rubber record which we have described with a novel mounting for his reproducing stylus. As appears from Mr. Berliner's patents, and also from the model exhibit of the gramophone, **Mr. Berliner has discarded all of the screws and gears used by prior inventors, and all of the complications incident thereto, among them the necessity for the minute lateral and vertical play of the Bell and Tainter joint, and has boldly caused the record groove itself to do the work of propelling the stylus and the whole reproducing apparatus, from its outermost to its innermost convolutions.** This invention is also one of a most important and valuable character. It dispenses with all the complications considered necessary before his invention thereof, in a manner as simple as it is possible to conceive. It dispenses at once with the screw gear and with the peculiar loose joint, with its tiny amount of play for the stylus mounting, made necessary by the screw gear. This idea has been patented to Mr. Berliner in his patent No. 534,543, and more particularly in claim No. 5 (R. p. 102). It has been considered by all who have had reason to examine the subject as one of the great steps in the art of sound reproduction.

If we consider, then, the history of the two inventions of the Bell & Tainter graphophone, and of the Berliner gramophone, and the results thereby attained, it will be apparent to any one skilled in patent matters, from the very history of the art, that there can be no substantial conflict between two inventions developed along such different lines. It is apparent, without any technical consideration of claims or patent specifications, that nothing that Bell & Tainter have done can, in any substantial way, interfere with the work of Berliner. Berliner started from Scott and developed the ideas of Cros. Bell & Tainter started from Edison and developed the ideas of Edison. Berliner converted the theories of Cros into a practical sound-reproducing machine. Bell and Tainter converted the ideas of Edison into the commercial graphophone.

Berliner, among other things, took the metal record tablet of Cros, with its laterally undulating grooves of even depth, and, by many improvements on the processes of Cros, converted it into a hard rubber record tablet with a laterally undulating groove of even depth. Bell and Tainter took the tin-foil cylinder of Edison with its groove having an undulating bottom, and converted it into a wax cylinder with a groove having an undulating bottom. Berliner used a mounting for his reproducing stylus, which should have a compass from the innermost convolutions to the outermost convolutions of the record, so that the stylus would be propelled across the whole record by the groove, without the necessity of screws and gears. Bell and Tainter took the stylus mounting of Edison, and, while retaining the screws and gears of Edison, gave it the tiniest possible amount of play, so that the stylus would automatically adjust itself to the bottom of their peculiar record groove.

The same appears from the following quotation from Pollok & Mauro's opinion (R. p. 84):

> "It is beyond all dispute that in its essential and distinguishing principles of operation the gramophone system is substantially and materially different from the phonograph or graphophone. The points of resemblance, if any exist, must be found in detail of minor importance, which would not affect the main question. The development of the two systems, however, has been upon divergent lines, so

that features peculiar and important to the one are of necessity inapplicable to the other;"

The distinctions between the two inventions is further emphasized by a consideration of the respective records of Bell & Tainter and of Berliner. These records are very well shown in two models filed as Exhibits in this case, one of which, that showing the Bell & Tainter record, has alread been referred to in this brief and is marked No. 1, and the other of which, that showing the Berliner record, is a small rectangular board of about the same size and shape, showing three Berliner record grooves, and is marked No. 2 on the back.

Although the models show the grooves in each case enormously magnified, yet the degree of enlargement is about the same in each case, and the proportions of depth and width and shape have been preserved as nearly as possible. The substantial truthfulness of these models, which was not denied below, is proved, among other things, by a comparison thereof with the two Chapman photographs, found on pages 146 and 147 of the record, which show microphotographs of cross-sections of the grooves.

Comparing, then, the Bell & Tainter and Berliner devices in view of these models, we find:

The Bell & Tainter groove is wide and the undulations constituting the record are efficient only at the very center or bottom of the groove, so that it is necessary for the stylus to laterally and vertically adjust itself within the groove to reach the bottom of the groove where the efficient record is found. In the Berliner device the grooves are U-shaped in cross-section, with steep side walls, as distinguished from gently sloping walls, and the efficient record is found along the upper edge of the groove; there is one, and only one place, at which the stylus can rest within the groove, and there is no possibility for a lateral adjustment of the stylus within the groove.

Again, in Bell & Tainter the side wall of the groove cannot act by lateral thrust or by a positive restraining action to guide the stylus, or to keep it in its track. This must be accomplished by the automatic centering action due to the vertical downward pressure of the stylus on the gently sloping walls of the groove. In the Berliner device the side walls of the groove are steep, embracing the stylus and acting to track it positively by lateral thrust, and not by any automatic centering action secured by vertical downward pressure. Such pressure is unnecessary for guiding the stylus within the Berliner groove, for if the stylus be slightly lifted off the bottom of the groove so that there is no longer any pressure, the side walls of the groove will still track the stylus.

Finally, in the Bell & Tainter device the undulations constituting the record are superimposed upon a groove in a direction perpendicular to the face of the record material. These undulations, therefore, act on the *point* of the stylus and tend to move it in the direction of its length and perpendicular to the face of the record material. The weight of the stylus mounting acts vertically downward. Hence, the weight of the loose stylus mounting gives an initial pressure between stylus and record. Without such initial pressure, there would be no sound reproduction. In the Berliner device the grooves have undulations imposed upon them in a direction parallel to the face of the tablet, and the working record is found and is efficient only along the upper edges of each groove. The weight of the stylus rests not on these undulations but on the bottom of the groove, where there is no record. There is, therefore, in Berliner, no initial pressure, yielding or otherwise, between the undulations constituting the record and the stylus. Besides, the undulations act on the *side* of the stylus. Even if the pressure of the stylus on the flat bottom of the record were dispensed with in Berliner's construction, and even if the stylus did not touch the bottom of the record groove, the side of the record groove would still touch the side of the stylus and thus vibrate the stylus quite as efficiently, and sound would be reproduced. This point is well brought out in paragraphs 25 and 26 of the Lyons affidavit (p. 129).

The same point is made with equal clearness in the opinion written by Mr. Philip Mauro, and known as Pollok & Mauro's opinion, which was given by the firm of Pollok & Mauro at Mr. Berliner's request in the summer of 1891 (R., p. 71), before Mr. Berliner entered into the business of selling gramophones. We quote from Pollok & Mauro's opinion (R., p. 83):

> "In the etched record, the point of the reproducing style is guided continuously by the parallel edges of the sinuous groove, the movement being side wise and positive in both directions. With the graphophone record the style vibrates up and down, and its movement is positive in one direction only, namely, when it is pushed upwards in ascending to the crest of an elevation. In descending into a depression, it must rely on the gravitation of the style, or on a spring, or upon the elasticity of the diaphragm, to make it follow the curve of the line, and to prevent its skipping from one elevation to the next. *From this it will be understood why in the graphophone the use of a style resting by gravity upon the record is a feature of so much importance. In the gramophone the use of a reproducer of this character is inadmissible. Neither gravity nor spring pressure is a factor of the operation. The style does not rest upon the record at all, but is free to swing in both directions as the edges of the groove between which it lies direct its movements.*"

We repeat, then, that the non-existence of any conflict between the inventions of Bell & Tainter and of Berliner is shown not merely by the history of these inventions, but also by an examination of the two types of record and the modes in which these records act upon sound-reproducing styles moving within them. A lateral adjustment within the groove is absolutely necessary for sound reproduction in the type of record shown by Bell & Tainter. Such lateral adjustment within the groove is absolutely impossible with the type of record shown by Berliner. An automatic guiding or centering of the stylus within the groove by means of a vertical yielding pressure, and not by the lateral action of the side walls, takes place in Bell & Tainter. Such guiding of the stylus is effected by the lateral thrust of the side walls of the groove in Berliner. An initial yielding pressure of the *point* of the stylus against the undulations constituting the record is imperative and necessary in the Bell & Tainter invention, in order to keep the stylus at all times in operative touch with the undulations to make sound reproduction possible. There is no initial yielding pressure between the stylus of Berliner and the undulations constituting the Berliner sound record. Such pressure is unnecessary, because sound reproduction has nothing to do with whether or not the point of the stylus rests in the bottom of the groove.

VI. THE ECHOPHONE AND ITS RELATION TO THE GRAPHOPHONE AND TO THE GRAMOPHONE.

Before going on with the consideration of the decisions by Judges Grosscup and Shipman, adjudicating the patent in suit, it may be well to examine the construction and operation of the specific machine which was before them and to determine its relation to the Bell & Tainter graphophone, and to the Berliner gramophone. The sound-reproducing machine which was considered by these learned Judges was substantially the same in each case, although it was called the Metaphone in the one case and the Echophone in the other case. We may here refer to it as the Echophone.

The Echophone is a machine designed for reproducing sound from a wax cylinder carrying a cut or engraved record, with the undulations most pronounced at the bottom of a shallow groove, being, in a word, the identical wax cylinder records which are sold by the complainant corporation. The stylus is carried at the end of a glass tube, the other end of which is mounted in a universal fashion so as to be free to rise and fall, being held down by spring pressure, and being propelled from the convolutions of the groove at one end of the record to the convolutions of the groove at the other end of the record, by the convolutions themselves, and without any other gearing or screw mechanism (p. 155).

Now, at first blush, and without more than superficial examination, an argument would suggest itself that since the Berliner gramophone employs a mounting for its stylus similar to that used by the echophone, that the gramophone must be considered an infringement of complainant's rights, if the echophone was so considered. This argument, however, falls to pieces when we bear in mind that the echophone uses a wax cylinder precisely like that described in the Bell & Tainter patent, and, in fact, the very same wax cylinder that is sold on the market by the complainant-appellee, with very broad and very shallow record grooves, having sound undulations at the bottom of the grooves. When then the stylus of the echophone rests on one of these grooves, its vertical motion effects the function which is effected in the Bell & Tainter patent, of pressing with a yielding pressure against the undulating record in the bottom of the grooves. So, too, when the echophone stylus rests on the record groove of the Bell & Tainter wax cylinder, its capacity for lateral adjustment permits it to slide down the gently sloping walls of the record groove to reach the bottom of the record. That is to say, the stylus, by reason of the lateral adjustment of its mounting, is permitted to laterally adjust itself within the space or width of a single groove. Manifestly, then, there is no escape from the conclusion that the echophone stylus mounting, when used in connection with the wax cylinder of the Bell & Tainter graphophone, constitutes an infringement of the graphophone construction.

But let us examine what would happen if we were to use the stylus and mounting of the echophone on the hard rubber gramophone record of Berliner. It is plain at once that the vertical adjustment and spring pressure would no longer have the function of pressing the stylus in a yielding manner against the undulating record; for, since the stylus would substantially fit the cup-shaped record groove of the gramophone tablet, there would be no initial pressure between the side walls of the stylus and the undulating side walls of the record grooves, which constitute the record. So, also, since the echophone stylus, when used in connection with a gramophone tablet, would co-operate with cup-shaped grooves with steep side walls into which it fits, there could be no question of a lateral adjustment within the width of a single groove. The stylus would be put at the single and only place in the groove where it belongs. Nor would there in such case be any possibility of automatically selecting one or other of two adjacent grooves, for if the echophone stylus when used on a gramophone tablet, got on the ridge between two adjacent grooves, it would stay there.

From the fact, then, that Judge Shipman found the echophone mounting and stylus, when used in connection with the peculiar record grooves of the Bell and Tainter wax cylinder, an infringement of the Bell and Tainter Patent, it by no means follows that he would so have considered the combination of this echophone stylus and mounting when used with a gramophone tablet. Indeed, when the facts are considered, it is quite certain that he would have held to the contrary.

In this connection we may point out that the echophone is a mongrel or hybrid device, being in fact in some respects like the graphophone and in other respects like the gramophone. **In so far as the echophone utilizes the idea of dispensing with all screws and gears, and of having the record itself do the work of propelling the stylus, it is an infringement of Berliner's invention as covered by claim 5 of his patent No. 534,543, before referred to.** In other words, the echophone comprises within itself two inventions, the one being its capacity for carrying out certain ideas of Bell and Tainter, the other being its capacity for executing the ideas of

Berliner. The only feature or function or capacity which Judge Shipman had in mind were those which belong to the Bell and Tainter side of the device. He did not have before him those features which belong to the Berliner side of the device, for these were never raised, and, therefore, never considered or decided. Neither was it necessary to decide them so long as the echophone stylus carrying arm was used in connection with Bell and Tainter's wax cylinder.

But we must here point out that, although the echophone happens to have features capable of being used either with a gramophone tablet and other features capable of being used with a graphophone cylinder, this double adaptability is by no means true, either of the reproducer construction actually used in the gramophone, or of the reproducer construction used in the graphophone. That is to say, it is not possible to take the mounting for the diaphragm and stylus of the graphophone and use it efficiently on the gramophone. Neither is it possible to take the diaphragm and stylus mounting from the gramophone and use the same efficiently on the graphophone. The reason for this lies in the fact that both the gramophone and the graphophone use a diaphragm to increase the volume of sound. In the graphophone the diaphragm must be perpendicular to the stylus, and, therefore, parallel to the surface of the wax cylinders. This follows from the fact that the record is in the bottom of the record groove. In the gramophone the diaphragm is parallel to the stylus and is perpendicular to the surface of the hard rubber tablet. This is necessary by reason of the fact that the sound undulations in the gramophone are found in the side walls of the record groove. If, then, the graphophone mounting were used in the gramophone tablet, the lateral undulations which would be imparted to the stylus would tend to move the diaphragm in its own plane, and not perpendicular to this plane, as it ought to do in order that the diaphragm may operate efficiently.

Complainants, in their brief filed below, assert, without proof of the assertion, that they have used the graphophone reproducer in connection with the gramophone record, and obtained sound reproduction. With a statement as broad and indefinite as this, we can take no issue; for we are well aware that any solid body, vibrated in any fashion, will emit sound. So we find that in the echophone a glass rod, when vibrated by a graphophone record, emits sounds, and we have no doubt that, when vibrated by a gramophone record, it will emit sound. But this is not a mode of operation contemplated either by the graphophone or the gramophone; in both cases the vibration of a diaphragm, at right angles to its plane, is the mode of reproduction that is contemplated.

If, then, the graphophone reproducer is used with a gramophone record, sound may be emitted, but it will be emitted not by the diaphragm, but in spite of the presence of the diaphragm.

If, however, the gramophone reproducer were attempted to be used on the graphophone wax cylinder, which, in the first place, the softness of the wax cylinder would make impossible, then the movements of the stylus imparted to it by the bottom of the record groove would tend to move the diaphragm in its own plane, and not perpendicular thereto. We see, then, that the presence of the diaphragm makes it impossible to use the gramophone reproducer with the graphophone tablet or the graphophone reproducer with the gramophone tablet and utilize the function of the diaphragm. In the echophone this diaphragm has been omitted, and therefore the echophone has the dual adaptability of being usable either with a gramophone tablet or with a graphophone wax cylinder. But we repeat, that when the echophone reproducer is used on a gramophone tablet, it has no function of laterally adjusting itself within a single groove, or of automatically selecting between two adjacent grooves, and no function of automatically pressing against the undulating record. It is plain, then, that no inference as to the alleged infringing character of the Berliner Gramophone can be drawn from the fact that the echophone has been held to infringe the Bell & Tainter graphophone patent.

VII. THE DECISIONS OF JUDGE GROSCUP AND OF JUDGE SHIPMAN.

We have next to consider the decisions of the Courts to see whether they substantiate the views we have above expressed, and here we first examine the opinion of Judge Groscup in the Amet case (74 F. R. 789). After reciting the general principles which underlie the operation of reproducing machines, Judge Groscup, in speaking of the labors of Bell & Tainter, says:

> "The chief mechanical problem before the inventors was the making of a suitable and practical substance of deposit or record."

The opinion then proceeds to point out the well known character of the Bell & Tainter wax record with its cut or engraved groove and its sloping walls, and the general method by which sound reproduction is effected from such a record. Thereupon the opinion quotes claims 22 and 24 of the patent No. 341,214, and proceeds in the following language:

> "It will be seen that, in order to follow the groove accurately, the reproducer must be loosely mounted, and this is accomplished by the universal joint described in the patent. Much stress is laid by counsel for complainant upon the patentability of the adaptation of this universal joint to the purpose of the graphophone.
>
> "If the validity of the patent depended upon this contention I would be disposed to hold against it, *for I can see nothing novel about the joint except its new use, and such adaptation to new use is not, in my judgment, patentable invention; but while this element, separately considered, is not invention, the combination which embraces it, in my judgment, is.*"

We have here a clear statement to the effect that, in the opinion of Judge Grosscup, the universal mounting of the reproducer in the graphophone, when that reproducer is considered by itself and aside from the wax record, is not a patentable invention. We have, furthermore, the express holding of the Judge that the combination of this reproducer with the wax record is patentable, for it is to be remembered that the wax record was the only one before the Judge. To emphasize this point, we quote the following sentences from the decision :

> "Without complainant's record the defendant's device would be useless. It is never used except in connection with complainant's record. In the practical use, therefore, of defendant's device one of the elements of complainant's combination is actually and necessarily employed."

As further emphasizing the point that Judge Grosscup considered the combination of the wax record and of a loosely mounted reproducer the patentable invention of the patent before him, we quote the following (italics ours):

> "The *substance* upon which the record is cut and the reproducer thus loosely mounted, by which it is enabled to follow the undulations of the groove, together constitute an effective portion of the mechanism. Either without the other would be useless for the purpose of a graphophone or a phonograph. Together they bring about a successful result. They therefore constitute patentable combination."

We conclude by quoting the following sentence from the decree in the Amet case, found in Vol. 74 of the Federal Reporter, page 1008:

> "The court further finds that any device which combines the reproducer described in claims 19, 20, 21, 22, or 24 of said patent with the grooved tablet or other body having a sound record as described in said patent, and especially in claims 22 and 24, is an infringement of complainant's patent No. 341,214."

Manifestly, then, if these complainants had to rely upon Judge Groscup's decision, there is nothing in the construction which he gave to their claims which would hold the defendant's device as an infringement. The only record which was before Judge Groscup, as we have said, was the wax record with a cut or engraved sound groove, and it was this wax record in combination with the reproducer mounted so as to press upon the undulations at the bottom which was held to be a patentable combination and invention.

We have next to examine Judge Shipman's decision (87 F. R., p. 873). After quoting a number of the claims from the Bell and Tainter patent No. 341,214, the opinion goes on to refer to the prior art, and more especially to the work of Cros and of Edison, whereupon it dismisses the French device from consideration, and describes more specifically the work of Edison. The opinion thereupon proceeds to give a history of the work of Bell & Tainter. From this part of the decision we quote the following sentences:

> "*The material of the record and the reproducer are each necessary parts of the invention. Either part without the other would be ineffectual, but in combination both tend to make an operative and successful instrument.*"

The opinion goes on to refer to Judge Groscup's decision, and to emphasize the fact that Judge Groscup considers the combination of record and reproducer a patentable invention. Judge Shipman then says:

> "This peculiarity of the *dual* invention of the material for an engraved record and the reproducer and the fact that the latter was brought into being to make the former of practical value is of much importance in the proper construction of the quoted claims of the patent, if it should be held that the reproducer alone, though novel, is not patentable."

Thereupon the defenses to the claims of Bell & Tainter are discussed, and to this end the work of

Edison as shown for instance in his British patent of 1878 is considered. Speaking of this work, Judge Shipman says:

> "He (meaning Edison) did not use, unless experimentally, the blank made of wax or a waxy substance which was to become *by itself* a sound record to be used for reproduction."

The Judge then goes on to consider the work of Cros, which he does in the following language:

> "It is unnecessary to describe the theories of the French scientists in regard to the material for recording, because, while they used wax or stearine or paraffine upon the surface of the recording cylinder, made of metal or of glass, none of them attempted to reproduce the sound from the wax or paraffine or stearine record, *but the reproduction was made from the metal surface.*
>
> "The declaration in the specification that 'no one has reproduced sounds from a wax record by rubbing a style or reproducer over it' is true, and it is furthermore true that this combination, as shown in the patent in suit, either in method or operation or in the character of its result, converted the noteworthy but short-lived instrument of Edison into a machine of widespread use and permanent utility."

Manifestly the Court here had in mind simply a sound reproducer in which the wax-like blank which had been originally used for recording could, by itself, be used for reproduction. That is to say, it had in mind a device of the character of Edison, *and threw out of consideration devices like those of Cros, in which the same tablet which is used for recording is not used for reproducing.* But if Judge Shipman threw out devices of this character as having no bearing on the question of anticipation of the Bell & Tainter claims, manifestly his Honor at the same time held in effect that the Bell & Tainter claims, as he construed them, would not be infringed by such a device; for it is well-settled law that things, when subse quent, which are an infringement of claims would, if prior in point of time, be an anticipation thereof.

After Judge Shipman has fully disposed of the prior art and the various defenses, he sets forth the importance of the Bell & Tainter patent in the following language:

> "The two improvements of importance, with respect to claims 19 to 24, inclusive, are the new *material* for a sound record upon which *vertical* undulating grooves with *sloping* walls were *engraved* by a *cutting* style; and the reproducer, which rested upon these grooves *by gravity*, and moving along them, 'imparted to a second diaphragm the vibrations incident to the elevations and depressions *of the bottoms of the groove*.'"

The opinion again refers to the fact that Judge Grosscup was not disposed to regard the adaptation of the universal joint to the reproducer as patentable, when considered by itself. Judge Shipman may have been inclined to the opinion that this universal joint of complainant in the reproducer might be patentable in itself, because, as he said:

> "The style needed not only the lateral motion produced by the universal joint, but also an elastic and yielding pressure against the record."

We call attention to the fact that the purpose of the lateral movement in the gramophone is entirely different from the purpose of the lateral movement in the graphophone; and, as is fully established, that there is no elastic and yielding pressure against the undulations constituting the record in the gramophone, because the record is on the side walls of the groove, and the reproducing stylus fits the said walls so that the pressure is all on the point of the stylus at the bottom of the groove, which is of even depth and is not the record. Even, therefore, if Judge Shipman had made the holding that the universal mounting of the reproducer in the graphophone is patentable *per se*, which he did not, such holding would not affect the question involved in the present motion, because the capabilities which he attributed to the universal mounting are not found in defendant's machine.

Judge Shipman then goes on to say:

> "But if the reproducer is not patentable by itself, I fully agree with Judge Grosscup's idea of the patentable character of the combination which appears in these claims, and concur with him that any device which contains the reproducer described in claims 19 to 24 with a grooved tablet, or other body having a sound record *as described in the patent, and especially in claims 22 and* 24, is an infringement on the patent in suit."

This is substantially the language of the decree in the Amet case (74 F. R. 1008). Claim 22, be it noted, describes a reproducer having a rubbing stylus, which means a style having a certain amount of *initial* pressure against the record over which it slides, which is not the case in the gramophone. It furthermore specifies that the reproducer is free to move laterally to adjust itself to the groove; and there is no such adjustment in the gramophone. Claim 22 has in fact been expressly withdrawn by complainants and infringement thereof is not now alleged. Claim 24, on the other hand, describes a record of wax or wax-like material, and there is not now and never was a pretense that the defendants-appellants use such record.

As conclusive proof of the fact that Judge Shipman did not propose to give claims 19 to 24 of the patent in suit a construction as broad as the patentees may have hoped for, we quote the sentence immediately following those just quoted:

> "This construction is not so broad as that which the solicitor for the patentees apparently hoped for, but it limits the claims to the improvement which, *in combination*, created the new machine, and which are abundantly described in the specification."

Considering the question of infringement, Judge Shipman held that a record made of metallic soap, the material being wax-like and capable of being cut like wax, was within the Bell & Tainter claims. Judge Shipman also held that since the defendant's reproduction machine was designed solely for reproducing the wax-like sound records of the patent, it was an infringement of the claims in question.

In concluding his opinion Judge Shipman used the following language:

> "Let there be an interlocutory decree against an infringement of claims 19, 20, 21, 22, 23 and 24, and for an accounting, *which will be drawn substantially in the form settled by Judge Groscup in the Amet case*, and printed in 74 Fed. Rep. 1008."

But the decree in the Amet case is one which confessedly gives a construction to claim 21 which is too narrow to reach the defendant's device.

The extracts which we have made from the decisions and the comments which we appended to the extracts fully and conclusively prove that so far as the Bell & Tainter Patent No. 341,214 has been in litigation up to the present time, and so far as the claims thereof have received judicial construction, the greatest breadth which has been given to them has been to hold as tributary thereto wax or wax-like tablets or cylinders with record grooves cut or engraved thereon, which grooves have sloping walls and have the sound undulations efficient only at the bottoms of the grooves. In none of the adjudicated cases did any of the defendants use anything but such a wax-like record in which grooves, of the specified shape, were cut or engraved. Therefore, in none of the adjudicated cases was it necessary to decide more than the novelty of this one feature, and if more had been decided it would have been a mere *obiter*. But the fact is, that the Courts, in the adjudicated cases, did not attempt to go beyond the wax-like record with the engraved groove of the specified shape. This element has been the basis of every decision sustaining the patent. No adjudicated case holds a device which does not employ such wax-like record as an infringement. In addition there has been held valid the combination of such wax or wax-like record with grooves of the character pointed out, with the reproducing stylus having a flexible mounting of a character to enable the stylus to automatically adjust itself within the width of a single groove along the sloping walls of the groove, to automatically find the bottom of the groove, and be held against the record at the bottom by yielding pressure. It cannot be seriously argued that the claims of the Bell & Tainter patent have ever been given a construction broader than that here indicated.

But such construction very clearly throws out the defendants' machine as an infringement of the complainant's claims; because the defendants confessedly use no wax-like record, but a hard rubber record, so hard that it can hardly be cut with a knife, and can certainly not be cut with a recording style; because they use no engraved groove and no groove with sloping walls of the character required; and no record efficient only at the bottom of the groove and vibrating the style perpendicular to the record surface. Furthermore, the defendants use no combination of such a record and a reproducer in which there is an adjustment of the style laterally within the width of a single groove, or in which there is an automatic falling into one of two adjacent grooves from the ridge between the grooves, or in which there is a yielding pressure against the undulation constituting the record.

VIII. On Motion for a Preliminary Injunction a Claim may not be given a Construction Broader than that of the Adjudications Sustaining it.

On a motion for a preliminary injunction, the claim of the patent must be construed, not by means of the specification of the patent, but in view of the prior adjudications. It is not the language of the claim which controls, nor is it that language explained in the light of the specification of the patent. The controlling consideration is the construction which the Courts have given the claims upon which an injunction is asked.

This principle is so elementary and so truistic in character that some explanation is necessary to justify this attempt to establish it by citation of authority. The explanation is that although the principle was insisted on in our brief filed in the Court below, the Court below wrote its opinion on the basis that the specification was the proper instrument by means of which to construe a claim on a motion of this kind, and gave no intimation in its opinion that the principle relating to the effect of prior decisions for which we contend had ever been considered by it, and, if considered, whether the Court agreed or disagreed with it.

A claim is not a dead thing but a living thing. As such it has a certain amount of elasticity and adaptability for the needs of the patent. It is true that a claim may not be construed out of all semblance to its expressed shape. There are certain limits, both superior and inferior, within which legal construction must confine its scope. But those limits are wide, and within them the power of construction reigns supreme.

Now, manifestly, it means but little to say that a certain claim of a patent is valid. It may be valid on a narrow construction or on a broad construction. Its scope may be so minutely limited by construction that it covers nothing but the specific device of the patent and colorable evasions of it. Or its scope may be made so broad as to cover a large field of devices. It is clear, then, that a claim broadly construed and a claim specifically construed are in law and effect two separate and distinct claims. They are just as different, in law, as if they had been separately written down in the patent, and had been given separate numbers. When, then, a patentee goes into Court and succeeds in having his claim declared valid on a narrow construction, this means that he has had a certain restricted field apportioned to him for his monopoly. When, on the other hand, he succeeds in having his claim sustained on a broad construction, it means that he has a different field given to him, covered, in effect, by a different claim.

It is, then, clearly impossible in patent jurisprudence to disassociate the idea of the validity of a claim from the idea of its legal construction. The two ideas are inseparably connected. The construction gives form, substance, and life to the claim. Therefore, on a motion for a preliminary injunction, it is not enough for the patentee to say that his claim has been held valid, unless he at the same time says what scope has been given to it, and shows that the defendant's device comes within this adjudicated scope. Otherwise, he may sustain one claim, a narrow claim, in the prior adjudication and obtain an injunction on what is, in effect, another claim, a broad claim, in a motion made for preliminary injunction. We proceed to cite the authorities.

The principle for which we are contending has recently been well stated by the Circuit Court of Appeals of the third circuit in Whippany Mfg. Co. *v.* United Indurated Fiber Co. (87 Fed. Rep. 216):

> "The complainant's patent was sustained by the circuit court of New Jersey in a suit against the New York Wood Fibre Company; *but it does not appear that the construction there given it was such as is now claimed, and broad enough to cover the respondent's process, and thus subject them to the charge of infringement.*"

This Court in American Paper Pail & Box Company *v.* National Folding Box & Paper Co. (2 C. C. A. 167; 51 Fed. 229) did not consider it necessary to announce so obvious a proposition in set terms. But it did what is quite as effective. It practically applied the principle, showing that the Court recognized its binding force. The Court said:

> "Under this statement of the question upon the appeal, *we follow* upon this hearing *the construction*

> *of the second claim of the patent which was adopted by Judge Lacombe in the Nugent Case, and which sustained its novelty and patentability.*"

Thereupon the Court, speaking through Judge Shipman, went on to state precisely what that judicial construction was, and to show that the defendant's device came within the claim as thus construed.

The principle has also been repeatedly announced by the Circuit Courts. Perhaps the clearest statement of it is found in the trenchant language of Judge Lacombe in the case of Carey *v.* Miller (34 Fed. 392), in which the well-known patent for the manufacture of furniture springs was involved. This patent had been repeatedly sustained and held to cover a process in which the springs, during tempering, were kept below red heat. Judge Lacombe, in dismissing a motion for a preliminary injunction, in speaking of the patent, said:

> "It may be sufficiently broad to cover any degree of heat whatever, but that has not as yet been held by the Courts which have had it under consideration. Therefore, upon application for a preliminary injunction, the patent will be presumed valid only to the extent expressly covered by the decisions referred to."

So, in the Consolidated Safety Valve Company *v.* Ashton (26 Fed. Rep. 319, Colt, J.), the Court had before it a patent which had been sustained by the Supreme Court. But as there was a doubt whether the alleged infringing device came within the scope of the patent, as construed by the Supreme Court, a preliminary injunction was refused.

We may next extract from the case of the National Hat Pouncing Machine Co. *v.* Hedden (29 Fed. Rep. 147), as follows:

> "It has been held to be 'well settled that, even after the validity of a patent has been established in a suit, and notwithstanding the presumption thereby raised that the patent is valid, it may

> always be shown in another suit on the patent against another defendant, and even in answer to an application for a preliminary injunction in such suit, *that the right claimed by the plaintiff in the new suit was not, either as to its nature or its extent, fairly in controversy in the former suit*, or that material facts were not known or considered when the former suit was tried, or that there are relevant matters which were not adjudicated in the former suit.' (Page *v.* Holmes Burglar Alarm Tel. Co., 2 Fed. Rep. 336.)"

In Société Anonyme Du Filter Chamberland *v.* Allen (84 Fed. 812), Judge Hammond gave an extensive review of the authorities on this and similar questions and quoted, with apparent approval, the language of Judge Lacombe in Carey *v.* Miller, and the paragraph from the Hat Pouncing Machine Co. *v.* Hedden which we have just given, and also referred to the Consolidated Safety Valve Case, to which reference has just been made.

The principle has also recently been applied by Judge Coxe in Doig *v.* Morgan Machine Company (89 Fed. 490). In determining the question of infringement on motion for preliminary injunction, the Judge says:

> "Infringement is clear *under the construction given the claims in a former suit*."

In closing this portion of the brief, then, we beg to insist on the well-settled principle of law which declares that on a motion for a preliminary injunction the complainant must be satisfied with the broadest construction of his claims which the Courts have previously given thereto, and that he may not go beyond such broadest construction. But the broadest construction which the Courts have given to the Bell & Tainter claims limit them to a sound record of wax-like material having a groove of peculiar shape, with the record at its bottom, either alone or in combination with a mounting for the reproducing stylus which effects the peculiar function of permitting an automatic lateral adjustment of the stylus within a groove and of an automatic yielding pressure against the record in the bottom of the groove. The defendants' device, however, has no record of the character required. This, in itself, disposes of the matter. Besides, the defendants' mounting for the reproducing stylus does not have the capacities specified. For these reasons alone, we submit, the order appealed from should be set aside.

Section II.

I. THE COURT BELOW ERRED IN CONSIDERING THE QUESTION OF THE ALLEGED ADJUDICATED VALIDITY OF CLAIM 21 DIVORCED FROM THE IDEA OF ITS ADJUDICATED CONSTRUCTION.

In this section of the brief we consider the opinion of the Court below on which the order appealed from was based.

The opinion starts out by stating that it is difficult to see upon what theory it could be assumed that Judge Shipman had not held claim 21 of the patent valid in the Leeds case, in view of the fact that the decree which Judge Shipman signed in that case expressly held said claim valid.

But these appellants are not concerned whether or not Judge Shipman, in the Leeds case, made the naked holding that claim 21 is valid, for the reason, as has before been urged, that, on a motion for a preliminary injunction, a claim with no construction attached to it is no better than no claim at all. It will not do, we insist, to come before a Court with the assertion that a claim has been held valid, without at the same time showing on what basis it has been held valid, and what scope has been given to it. Giving due weight to this consideration and waiving the question whether or not, as a naked fact, claim 21 has been held valid, and attempting to ascertain the construction which has been given to it, we find, so far as we can ascertain this construction from an examination of the decree itself in the Leeds case, that said decree was directed against a machine which used a record cut or engraved in a wax-like material, which is not sufficient to sustain an order for injunction against these appellants. When, however, we leave the decree and attempt to learn the scope of the claim from Judge Shipman's opinion, then we find that the opinion pointedly declines to declare the reproducer of the claim to be patentable *per se*, and in the very last sentence states that the decree in the Amet case is to be followed. But the decree in the Amet case held the reproducer of claim 21 to be patentable only in so far as it was used in combination with a peculiar type of record defined by claims 22 and 24, which, confessedly, these appellants do not infringe. We repeat, then, that we are not concerned with the bare question whether or not claim 21 is valid. To sustain this order granting a motion for a preliminary injunction, there must, in addition, be established a judicial construction of the claim broad enough to cover appellants' device, and this, it is clear to mathematical demonstration, has not been done.

II. THE COURT BELOW FAILED TO NOTICE THAT CLAIM 21 COVERS, OVER FIGURES 1 AND 2 OF EDISON'S ENGLISH PATENT, AT BEST A MINUTE IMPROVEMENT, AND THAT THE CLAIM MUST THEREFORE BE NARROWLY CONSTRUED.

Proceeding with our consideration of the opinion of the Court below, we find that the Court was disinclined

> "to read additional elements into claim 21, thereby making it identical with one or more of the other claims which were also sustained."

There are several reasons why the Court below need not have felt so disinclined. One of them is, that the history of the art shows Bell & Tainter, at best, to have made but two inventions, the one a cut or engraved record on a wax-like material covered, for instance, in claims like that numbered 10; the other a combination of this wax-like record with the loosely mounted stylus having certain capacities and covered in claims 19 to 24. There is no proof that this second feature of their invention, the combination, can be split up into a number of parts, or that such feature has in it enough merit to justify more than a single claim. Whether or not the invention of the engraved record in wax-like material was broad and of a pioneer character, we shall not here discuss. But certainly the slight amount of lost motion in a flexible mounting for the stylus was not an invention of a primary character, but a mere detail, made necessary by the positive screw mechanism. There is, therefore, no reason to suppose that there are a number of distinct patentable novelties about this little flexible joint.

But, aside from this, it is a fact that the record is included in claim 21. This record is expressly mentioned in claim 21, and unless the record is considered as an element of this claim, the claim is anticipated in Figs. 1 and 2 of Edison's English Patent A. D. 1878, No. 1644 (R. p. 205). These figures do not seem to have been expressly called to Judge Shipman's attention in the Leeds case, and certainly he did not pass upon them. Figs. 1 and 2 show a machine complete in all its parts, with a full description that leaves no doubt as to its construction and mode of operation. The drawing shows a machine for reproducing, having a rotary table for carrying the record. It shows an arm *i* carrying a diaphragm acted upon by a stylus *c*, mounted on a spring e^2. The arm *i* is clearly shown and clearly described as mounted on a universal joint, the axis 5 permitting a vertical motion and the axis 6 permitting a horizontal motion. The stylus is propelled across the spiral 4, constituting the record, by means of an inner spiral 3, engaged by a pin on the arm *g*. We confess we cannot understand why the stylus *c* is not pressed against the record by yielding pressure, since it is mounted on a spring arm e^2, backed by a short piece of rubber tubing e^3, situated between the spring and diaphragm. Certainly this spring e^2 must be tensioned to press the stylus against the record, or else the apparatus would not do what it was intended to do.

However this may be, and independent of the question whether the spring e^2 presses the stylus against the record, the fact remains that it is impossible to eject the record from claim 21 of the Bell & Tainter patent, and have anything left in the claim which differs from Edison. To show this let us try to paraphrase claim 21, throwing out not only the word "record," but any reference to the idea of a record. The elements of the reproducer considered by itself are three in number. They are a stylus or its equivalent, a universal joint having both a lateral and a vertical motion through the intervention of which the stylus is supported, and a yielding pressure device, consisting either of a weight or a spring which tends to give the reproducer a trend in a direction vertically downward. But each of these elements, and in the precise relation, is found in the Edison reproducer. Edison English patent in Figs. 1 and 2 shows a stylus *c*. It shows a universally jointed arm *i*, the universal joint being composed of the axes (5) and (6), which arm *i* carries the stylus *c*. It furthermore shows a construction in which there is a trend downward due to the weight of the parts on the left of the axis (6). It will be seen, therefore, that **it is impossible to read claim 21 for a reproducer alone without referring to the record and yet have claim 21 define a difference of any sort over Edison, to say nothing of a difference of a patentable sort.**

Now, on what theory will our opponents seek to sustain the patentability of claim 21 over Edison? They will say that the Edison stylus does not press with yielding pressure against the record. To substantiate this, they will further say that Edison's record was so perishable and soft that if he had permitted his stylus to rest upon the record groove and be pressed down by yielding pressure, the pressure would have ironed out and obliterated the undulations of the record. For this reason, they will say that the weight of all the parts to the left of the axis 6 in Fig. 1 must have been carried, say, by the pin on the arm g, which works in the spiral 3. This takes no account of the question whether the spring e^2 may not itself be the yielding pressure device. But aside from this, if all that our opponents can say on this subject is true, it yet resolves itself into this: that the distinction which Bell & Tainter have over Edison lies in the hard record capable of bearing the weight of the stylus mounting without obliterating the record, and not in the stylus mounting or reproducer itself. Bell & Tainter may have made an invention in the record. They made no invention in the reproducer *per se.* The most they can urge over Edison for the reproducer is that, in the combination with their peculiar record, it has certain peculiar functions or capacities which entitle this particular combination to be considered as patentable.

When, therefore, the Court below declines to consider the record as involved in claim 21, it obliterates the only distinction that the claim can express over the prior art as shown in Figs. 1 and 2 of Edison's English Patent. Either claim 21 embraces the record or claim 21 is for the reproducer alone and hence is anticipated in Edison, who shows the reproducer mounted on a universally jointed arm having a vertically downward trend. The appellants are not concerned with either alternative.

The fact is that Edison in his English patent was not limited to tin-foil records. He also contemplated the use of metal record (R. 199, l. 38; 198, l. 26). Not only is there no reason why the stylus may not press yieldingly against such metal records, but it is necessary that such pressure should be exercised by the stylus in order that sound may be reproduced. Manifestly, too, Edison was entirely familiar with the idea of using a yielding pressure against the record, as may be seen, for instance, from Fig. 19, where there is a lever, e_2, acted on by a spring at one end to press the stylus at the other end against the record. So too in Fig. 9. of Edison, there is nothing which supports the weight of the stylus mounting except the record. We must remember that we are not concerned here with any question as to the novelty of the record. The complainants admit we do not infringe their record. We are concerned merely with the alleged novelty of the reproducer and all that the Bell & Tainter reproducer can possibly define over Edison's Figs. 1 and 2, is the feature of the yielding pressure against the record. No reason is seen why these figures themselves do not disclose the yielding pressure. The only reason given to the contrary applies to the case of a tin-foil record and not to a metal record. But Edison used metal records and his patent discloses that he used a yielding pressure against the record.

III. THE COURT BELOW SHOULD HAVE CONSTRUED CLAIM 21 IN VIEW OF THE ADJUDICATIONS. CONSTRUING THE CLAIM IN VIEW OF THE PATENT SPECIFICATION, IT ERRED IN READING "RECORD" AS IF IT MEANT "GROOVE."

We have above called attention to what we conceive to be the primary and fundamental error in the opinion of the Court below, which consisted in disassociating the idea of the validity of claim 21 from the idea of its construction, thus considering the claim not in view of the prior decisions, but in view of the Court's own idea of the meaning of the claim. We shall now proceed to discuss the opinion of the Court below, in so far as it goes on to define the meaning of the claim in accordance with its own views of what the claim means in the light of the specification of the patent. We insist, however, that what we have said in the preceding portions of this section of the brief sufficiently disposes of the matters in controversy here. What we shall proceed to say on the construction which the Court below gave to claim 21, in view of the specification of the patent, and disregarding the prior adjudication, may be taken, as it were, *de bene esse.*

In the paragraph of the opinion of the Court below following the quotation of claim 21 (R. p. 214), the Court gives its idea of the meaning of the word "record" as used in claim 21. Now, we beg to submit at the outset that the natural meaning of the word **"record" is the inscription of the sound,** meaning the undulations which represent the sound, and is neither the groove upon which the undulations are superimposed, nor the material in which the grooves are formed. The record commonly and naturally means the inscription. The word "groove" naturally means a depression in a longitudinal direction along the face of the material in which it is made, and has no relation, primarily, with the idea of a sound undulation. The words "record material" explain themselves. The meanings of the words "record," "groove," and "record material" are so fundamental and natural that the proof will lie heavily upon him who attempts to establish a different meaning for these words.

But the fact is, that the specification of the patent uses the word "record" about eighty times. In claims 7 and 8 "sound-record" is by plain mistake applied to the record material, which mistake becomes evident from claims 17 and 18. So, too, in two or three places the word "record" is used as meaning what Edison calls the "phonogram," which may also mean the record material or tablet. **But this excepted, there is not a single place in all the patent in which the word "record" may not naturally be taken to apply to the idea of the sound undulations which constitute the record.** If there is any confusion at all, it is not as between the record and the groove, but as between the record and the record material. The patentees have been careful to keep their terms distinct. We shall not weary the Court by reciting each use of the word "record" in the patent. We merely repeat that with a full understanding of the facts, the word "record" in every instance, except those which we have specifically pointed out, may be taken to mean, and actually does mean, the sound undulations.

The two citations from the patent specification which are given in the opinion of the Court below to substantiate the view of that Court that the terms "record" and "groove," used in the patent, mean the same thing, is based upon a misapprehension of the facts. The Court below assumes that the undulations constituting the record were found only at the bottom of the groove. Now, while it is true that the most efficient undulations are found here, it is equally true that the undulations extend along the sides of the groove. Thus, the Court below quotes the passage from the patent, which says:

> "No special care is necessary to insure its adjustment, for if the reproducer K be allowed to rest against the record with the style upon the engraved line, the style will of itself gravitate to the bottom of the groove."

This means that, if the reproducer is placed upon the record at any point, whether along the side walls, where the record is inefficient, or nearer the bottom, where it is more nearly efficient, the stylus will of itself gravitate to the bottom of the groove where the record is efficient. It does not mean that the groove and record are the same things. So, too, the Court below quotes the following:

> "Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the record."

This extract means that, although the record is found both at the bottom and the sides of the groove and is efficient only at one place, the bottom of the groove, the style automatically adjusts itself to this proper place. The extracts which the Court in its opinion gave to show that the words "record" and "groove" mean the same thing, far from proving this point, emphasize the limitations which the patentees have put upon the capacity of their reproducing mechanism. For this reason we have quoted the same extracts in the first section of this brief.

The opinion of the Court below goes on to speak of the "floating reproducer." It says:

> "This floating reproducer of Bell and Tainter was adopted to put itself in place and keep itself in place despite the various disarrangement of parts to which machines of this class are liable."

Now it is true that the reproducer of Bell and Tainter does *put itself in place*, as we have repeatedly pointed out, either by sliding off from the ridge between two record grooves or by sliding down the inefficient side wall of the record to reach the efficient bottom of the record. So, too, the Bell & Tainter reproducer keeps itself in place by reason of the automatic centering action of the yielding pressure against the record as distinguished from the action of the side walls of the groove.

But when the Court below says that in the Berliner machine

> "the same automatic action is secured in the same way"

we are compelled emphatically to dissent.

Certainly the Berliner reproducer does not automatically *put itself in place* on the record or in the groove *in the same way*. The stylus must be put into the groove by hand. By examining the Chapman photograph of the gramophone groove (R. p. 147), it will be seen that there is a wide flat space between two adjacent gramophone grooves from which it would be impossible for a stylus to gravitate into either of the grooves. This flat plane between two gramophone grooves as distinguished from the sharp ridge between two graphophone grooves, changes the entire principle by which the stylus must be put in place. This matter has been fully explained in defendants' affidavit; see, for instance, paragraphs 41-42 of the Lyons affidavit (page 135, R.) But even more convincing is the fact that the claims specifically reciting this feature, numbers 19 and 20, involving as they do the lateral adjustment, have been withdrawn by the appellees.

IV. The Court Below Gave Claim 21 a Construction Which Is Broader Than Was Warranted by the Specifications or the Prior Art.

The extent to which the Court below went in giving a broad construction to claim 21, and a construction which, as we contend, is not warranted by the specification of the patent, much less by the prior adjudications, appears from the following expressions used in the opinion:

> "and it would seem to make little difference whether that surface (being the irregular surface which preserves the sound waves) was located at the bottom or at the side of the groove."

That is to say, the location of the actual undulating record surface with respect to the groove has nothing to do with the combination of claim 21 as construed by the Court below. This, however, as a necessary logical consequence, involves the conclusion that the undulating record forms no part of the claim, for **if it is immaterial whether the record be on the sides or on the bottom of the groove, it is immaterial, so far as the direct purpose of claim 21 is concerned, whether the record is in the groove at all, for under such construction the stylus does not co-operate with the record, but with the groove.**

We wish, at this point, to make clear a matter about which there is no conflict between the parties. It is this, that with the types of stylus mounting used by Bell & Tainter, the rate at which the mounting itself can vibrate is low, say about two or three times per second.

That is, supposing the diaphragam were not in vibration and the mounting itself were set in vibration, not by sound, but by some grosser force, this mounting would vibrate a few times per second. Putting it in still another way, if you turn the mounting with the hinge uppermost so that the diaphragm and its support hang and swing therefrom like a weight of a pendulum, the stylus mounting will vibrate, say, two or three times a second.

On the other hand, the tiny vibrations that set the diaphragm in motion to reproduce sound have an average rate of two or three hundred per second. This rate of vibration is so rapid and the extent of the vibration so minute that it would take a microscope to see it. Now it is a fact that the excessively minute and rapid vibration of the diaphragm, due to the elasticity of the diaphragm, and acting to reprodue sound, does not affect the stylus mounting as a whole, which has the vastly slower rate of vibration. It is very much like the case of the "rollers" at sea. No one who has crossed the Atlantic has failed to notice them, in long swells, and constantly moving great masses of water up and down, in beautiful wave-forms. But when the wind stirs, there is superimposed on these large rolling waves a set of smaller ripples, there being hundreds of small ripples on a single roller. These tiny ripples do not, of course, practically affect the motion of the roller as a whole. Just so, the tiny and rapid vibrations caused by the sound undulations themselves in sound-reproducing machines, corresponding to the ripples, do not act to move the stylus mounting as a whole, the rollers of the above illustration, in correspondence therewith.

Nothing that we have here said, however, is to be taken as in any way contradictory of what has been before said about the peculiar capacity of the universal joint in the combination of claim 21 in so far as it results in keeping the point of the downwardly gravitating stylus in pressure touch with the vertically undulating record. While gravity may not be sufficiently quick to follow each portion of each successive undulation in the vertically undulating record, it is still sufficiently quick to keep the stylus point in constant touch with the record. In the Berliner gramophone, however, the stylus receiving motion, not from its point but from its sides, may move up and down in the groove, so long as it simply remains in the groove, and it will still be acted upon by the sound vibrations.

Returning now to a consideration of the breadth of construction which the Court below gave claim 21, we see that it substantially read the word "record" out of the claim, for if the record be not at the bottom of the groove, then of course the stylus does not press against the record, but only against the groove. The claim as thus construed becomes a claim for the combination of a stylus, a universal joint having a downward trend, and a groove, the idea being that the universal joint permits the stylus to remain within the groove despite the grosser irregularities or eccentricities which the groove may have by reason of imperfections in the construction of the machinery. That is to say, the universal joint does not have any function, when the claim is so read, of co-operating with the peculiar irregularities of the groove that cause the sound vibrations. It co-operates merely with those irregularities inherent in the construction of the machine, as such, independent of whether it is a sound-reproducing machine or any other kind of machine. **Claim 21 so construed calls for a combination which, in essence, has no longer any peculiar relation to the art of sound reproduction. It calls for a combination by which the tracking of a rod or stick in a groove is effected by a yielding pressure and by a universal joint, to compensate for such irregularities as all grooves constructed by human machinery are subject to.**

It is in effect the case of a small boy who carries a stick in his hand and, as he walks along the street, sees a crack or crevice in the pavement. Nothing is more natural for him than to put the point of the stick in the crevice or groove and to trail the stick along behind him, keeping the point always in the groove. Now there is no boy who has ever performed this experiment who has not understood that it will not do to hold the stick firmly and unyielding in the hand. A certain amount of play and lost motion must be allowed. The hand must in effect become a universal joint, otherwise the point of the stick will fly out of the groove or else the handle of the stick will be twisted from the hand of the boy. Now it is this combination, as thus illustrated, which the Court below, by reading out of the claim the record and its position in the groove, in effect, gave to the claim, namely, a combination for tracking a stick moving in a groove, subject to such irregularities as all grooves are subject to, by means of a loose mounting for the other end of the stick.

But even then the Court below overlooked the fact that in thus construing claim 21 it was still necessary to give the element of yielding pressure in the claim a different function than it possesses in the Bell & Tainter construction, in order to make the claim cover the Berliner gramophone. As we have above pointed out, the yielding pressure in Bell & Tainter has the function of keeping the stylus tracked within the groove by the vertically downward action of the pressure, as distinguished from the lateral thrust of the side walls, as the stylus moves from point to point of the record. But in Berliner, the yielding pressure has the function of simply holding the stylus down within the groove at any one point independent of the movement from point to point, and thus to keep the stylus from flying out of the groove. And yet everything that has ever been put on a track has been weighted to keep it from flying off the track.

We have before called attention to the specific difficulties which the combination of claim 21 was designed to overcome and the excessively minute distinction, if any, which it defines over Edison's English patent. We have spoken of the very peculiar functions which the

Bell & Tainter stylus mounting has when used in combination with their very peculiar sound record and which alone imparted patentability to the claim. That is, we have shown how specific in character this claim is. We have also shown how broadly the claim must be read in order to make even a pretense of covering Berliner's construction, one element of the claim being ejected entirely and other elements being given an unnatural meaning. We deny that such a stretch of construction would be proper with a pioneer invention of the broadest character. With the specific invention covered by claim 21, it is manifestly impossible.

The appellees have themselves recognized the narrow scope of claim 21 when they attempted to sustain it in the Leeds case. Thus their chief expert, Mr. Arthur S. Brown, in answer to a cross-question, says (R. p. 164):

> "A. Perhaps so, but whether or not under the assumed conditions the style would of itself gravitate to the bottom of the sound groove, as stated at lines 66 and 67 of page 4 of the Bell & Tainter patent, or whether the style would follow and adjust itself to the record, as stated at lines 83 and 84 of page 4 of the Bell & Tainter patent, *which functions and offices are essential to the universal joint of the patent*, are questions which cannot be determined by me with reference to a hypothetical construction which I never saw or heard of. *It is not all joints or constructions which allow movement in two directions at right angles to each other which constitute the universal joint of the Bell & Tainter patent, the universal joint of the patent being one which not only has these two movements, but has them in such a fashion as to perform the offices set forth in the patent.*"

So, in the brief which was filed by the complainants in the Leeds case, being the appellees in the present case, we find the following language:

> "The Self-Adjusting Reproducer.—The merit of this feature of the invention lies not only or mainly

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> in the fact that it does away with all necessity for adjustment, either laterally or radially, of the record cylinder, *and that it insures contact with uniform pressure between the reproducing stylus and the undulating line of the record. Its chief merit lies in the part it played in the development of the engraving method.*"

In other words, this reproducer finds its "chief merit" in having developed the engraving method which these appellants do not employ.

Since complainant's own expert in the Leeds case gave claim 21 a narrow construction, it is not just that these appellees should now be permitted to urge a broad construction for that claim.

But, in order to cover the device of these appellants, we find that it is necessary to give the claim a broad construction, as if it defined an invention of a pioneer character. We find it necessary to do violence to the natural meaning and to the specification by construing the word "record" as if it meant "groove." We then find it necessary to read the claim as if it had no relation to features peculiar to the sound undulations, but as if it were for the broad idea of tracking a part within a groove by means so old and common that every school boy uses them; and to overcome difficulties inherent in all machines. Finally, we find it necessary to give the element of yielding pressure one function in claim 21, that of automatically centering or guiding from point to point, and another function in defendant's device, that of simply holding down the stylus to keep it from jumping out of the groove.

And when we have thus broadly construed claim 21, these appellants still ask: "In what suit did the appellees obtain such broad construction for their claims?" No such broad ideas were passed upon by Judge Shipman in the Leeds case. No contest has ever been had and no references have ever been cited or experted to claim 21 thus construed. The prior defendants used wax records. It would not have helped them to show that the idea of tracking a stylus in a groove broadly was not patentable, because the prior defendants tracked their stylus in the peculiar kind of a groove used by Bell & Tainter and thus effected the peculiar function effected by the combination in Bell & Tainter. But these appellants use a different record and a different mounting and develop other functions for their combination of record and mounting. To cover their device, claim 21 must be given a construction broader than any it has heretofore had and manifestly broader than any Court has considered. And this being true, the law demands that these appellants shall be given the right to test the patentability of claim 21 thus broadly construed, in view of a prior state of the art which it has never before been necessary to develop.

We may, at this point, discuss an argument which our opponents advanced below. It was this, that the laterally undulating and the vertically undulating records were both old and equivalent in the art at the date of the Bell & Tainter patent, and made so by the Edison Patent No. 200,521 (R., p. 160), which patent in Fig. 3 shows what is supposed to be a laterally undulating record. We shall not, at this point, spend time in disscussing the manifest absurdities of figure 3, which is supposed to show the laterally undulating record. Our ground is broader. Either Edison did something, and made a contribution of some value to the art, or he did not. In the one case Bell & Tainter are not pioneers; and their claims must be narrowly construed. In the other case, the fact that Edison showed two types of grooves as equivalents would not make them so.

Our position is, that both Edison and Cros mapped out the broad lines on which future improvements were to be grafted. Bell & Tainter developed to commercial utility the vertically undulating record of Edison with which alone Edison did any practical work. Berliner developed to commercial perfection the laterally undulating record of Cros. This gives to Bell & Tainter the field of the vertically undulating record, and to Berliner the field of the laterally undulating record.

But, however this may be, Edison and Cros certainly stand on the same footing. They either did nothing or they did enough to make what they describe a valid reference for so much as they describe. If they did nothing, then there is no prior art which shows the laterally undulating groove to be the equivalent of the vertically undulating groove. If they did enough to make them proper as references for what they show, *then Cros discloses the yielding pressure against the record*, for he expressly describes the stylus as held by a spring on the record (R., p. 167, l. 20), and furthermore, Edison in figures 1 and 2 of his English patent proves that Bell & Tainter are not pioneers in anything, unless it be the wax record, which would result in giving claim 21 a narrow construction and one not including the Berliner device.

Our opponents may also argue that these appellants use a construction in which the movement of their stylus mounting in a vertical direction permits the style to keep in the record groove despite any warping of the record plate which would throw the plate out of a true plane. If this be true the answer is that **the idea of using a lost-motion device for overcoming departures from an exact mathematical construction of machinery is so old and common in the arts that no one can obtain a monopoly for its use.** It is one thing to say that Bell and Tainter have a claim which covers a flexible or lost-motion mounting for a stylus, which co-operates in an especial way with an especial shape of the sound-record groove for a definite purpose to adjust the stylus automatically to the bottom of the groove, and it is an entirely different thing to say that these patentees have a claim that will prevent builders of sound-reproducing machinery from employing a lost-motion device not to effect a specific purpose but to effect the ordinary and old purpose of lost motion devices.

namely, to overcome departures from exact mathematical constructions inherent in commercial machines. One thing is certain, Bell and Tainter have never yet established their right to such a claim in any Court, and if they should attempt to establish such a claim in the present suit at final hearing, they will find that they will have to overcome a prior art very different to that they have heretofore had to overcome in establishing their claims to their peculiar kind of a lost-motion connection for effecting the peculiar adjustment repeatedly pointed out, when used in combination with their peculiar shaped record grooves. We maintain that their claims are not capable of such broad construction. We protest against assuming in advance that they will succeed in establishing any such broad construction for their claims, and we insist that they have as yet established no such construction for their claims. The experiments to which Mr. Lyons (R., pp. 131, 132) and Mr. Berliner (R., p. 75) have both testified, show that a vertical flexibility to compensate for a possible warping of the record plates is unnecessary in the gramophone art. Whether it is employed or not in commercial machines, need not now be considered, because these complainants have no claim for such features, have never established their rights for such features, and we insist never will establish their right to a monopoly therefor.

V. The Appellants' Peculiar Equities and the Laches of the Appellee.

The Court below seems to have given scant consideration to what we consider to be the peculiar equities of these appellants. We ask a careful consideration of such equities by this Court.

Mr. Berliner spent a number of years in his experiments for creating and perfecting his gramophone. He made no secret of his operations, but as early as 1888 published an account of such results as he had achieved at that time, in a paper read before the Franklin

Institute (R., p. 172). Mr. Berliner, also, took out a number of United States Patents for his invention, of which these complainants must be presumed to have had knowledge (R., p. 86–116).

Furthermore, before undertaking to launch the business of selling gramophones on the market, Mr. Berliner, as he affirms, (R., p. 71) in order to discover whether his machine was an infringement of any existing patent rights, took his gramophone to a gentleman of wide knowledge, skill and experience in the art of sound reproduction, and asked for his professional opinion on this question. The gentleman happened to be one who had been intimately connected with prosecuting the application for the Bell & Tainter patent in suit, and who is now the general counsel for the complainant corporation. The opinion which this gentleman gave was placed on very high ground, and was conclusive to the effect that the gramaphone infringed no existing patent rights, and in particular that it infringed no patent right of Bell & Tainter. Perusal of this extremely logical and lucid opinion convinced Mr. Berliner and all who claimed under him, as we believe it will convince this Court, of the correctness of the conclusion of non-infringement expressed in the opinion. A copy of the opinion is found on p. 77.

At this point we may refer to the fact that the affidavit of Mr. Mauro (R., p. 209) controverts certain statements made in the affidavits of Mr. Berliner (R., p. 19). Mr. Berliner's recollection is that he submitted to Mr. Mauro a reproducing apparatus with a hard rubber record and a reproducing stylus carried on an arm having both a lateral and a vertical swing. Mr. Mauro's recollection is that a reproducing machine substantially like that now in use was not submitted to him. We have here a positive assertion and a qualified denial. *The machine with the universally mounted arm had been invented at the time of Mr. Mauro's opinion, in* 1891, *since it is shown in the Berliner Franklin Institute lecture* (R., p. 189), *delivered in* 1888. To avoid any possible misconception, we insist that it is simply a question of the difference in recollection between two gentlemen of the highest standing in their respective professions. We may, without impropriety, however, urge that on motions for preliminary injunctions, doubts should be resolved in favor of the defendant. The conflict in recollection should raise a doubt sufficient for appellant's purposes.

On the basis of the opinion of Pollok & Mauro, Mr. Berliner went ahead to organize a company, and this company went ahead to build up a large business. As early as 1894, over a thousand gramophone machines and over 25,000 gramophone records had been sold openly and publicly and in direct competition with the machines of the Graphophone Company. That business has been constantly increasing, and in the present year its extent is measured by three quarters of a million of dollars. Gramophone machines fill a want not filled by other sound-reproducing machines, being particularly adapted and mainly intended for amusement purposes. Their great volume of sound, their freedom from liability to injury or wear, makes them far superior to any other type of sound-reproducing machinery for such purposes, and this is well proved by the fact that the price of a gramophone is still kept at twenty-five dollars, whereas other sound-reproducing machines are sold as low as ten dollars, and yet the sale of gramophone machinery is constantly increasing. All this is fully pointed out in defendants' affidavits (R. p. 53, 54, 64).

Now, what has been the course of these complainants in view of these operations of Mr. Berliner? Here was a machine sold in open competition with their machine, and known by them to operate on a different principle. Whether these differences are great or small, whether they are important or unimportant, no one can pretend that the American Graphophone Company and its agents were not aware of the fact that the differences existed. No one can pretend that the American Graphophone Company did not know that before it could succeed in holding the gramophone machine as an infringement of the graphophone patent, the question of the materiality of these differences, be they great or small, between the gramophone and the graphophone, would have to be litigated, contested, and adjudicated.

Despite this fact, these complainants below did not bring their bill against these defendants during all these years in which the defendants' business has been growing up. They did not notify by letter or otherwise any person or persons connected with these defendants that the operations of the defendants were considered an infringement of the plaintiffs' rights. The perfunctory statement to this effect in their bill is negatived by appellants' affidavits (R. p. 55, 64, 72).

On the other hand, the complainant-appellee brought suit against people who were using graphophone machines, not against parties who were using gramophone machines. It sued parties who were using machines built as closely as possible in imitation of the graphophone. It sued people all of whom were using wax or wax-like cylinders with shallow sound grooves having the undulations in the bottom, and it was in a suit brought against such machines that the complainant obtained the decree which it is now urging in the case at bar.

Broadly speaking, defendants have no quarrel with complainants on this account. The complainants below may have done what was wisest and best to protect their interests by testing their patent rights upon machines which were constructed in direct infringement of their own, so as to make certain, in the first place, to sustain their patents upon any construction of their claims, however narrow. The second step, that of attempting to broaden the construction of their claims so as to reach a larger and larger range of infringing devices, might follow later on. Complainants' course may perhaps have been a wise course and one which they had a lawful right to take.

But in taking this course they must not forget that there are questions to be litigated in the present cause which never have been litigated before; that such questions existed and were not in litigation in their former suits, and that their failure to attempt to litigate them during four years of active and public work on the part of defendants, resulting in the construction of a large business, would certainly deprive these complainants of the right to a preliminary injunction.

We understand perfectly that the activity of complainants in bringing suits on their patents on devices which fall within the scope of their claims on a particular construction of them was sufficient diligence to entitle them to an injunction against all future infringers who used the same device as those used by the prior infringers against whom suits had been brought, or devices which come within the same scope of the claims. But we insist that just as soon as these complainants attempt to give their claims a broader construction, and one embracing devices not embraced by the narrow construction, which alone they were obliged to enforce in their prior suits, just so soon does their laches count against them when they attempt to enforce such broader construction. A claim narrowly construed and a claim broadly construed are, as we have before said, in law and effect, two different claims. In this aspect of the case these complainants have been suing on their narrow claims and they have failed for four years to bring and to prosecute to final hearing a suit on their broad claims, either against these defendants or any other defendants of whom we have knowledge, and this while the defendants' business was being publicly pushed and was rapidly growing. We urge with all possible force that such laches on the part of the complainants, in so far as any alleged broader aspect of their invention is concerned, if it have a broader aspect, *which we deny*, has absolutely and unquestionably barred their right to a preliminary injunction.

Defendants have been building up their business honestly and in good faith. It is a business based on patented inventions of Mr. Berliner. Much money has been spent, much ingenuity has been exercised, much capital invested in constructing this business. Complainants, during all this time, have been silent. Instead of bringing suit against these defendants or even notifying any of them or any one connected with them that they intend to bring such suit, they have been prosecuting their patent rights against infringers who have closely copied their machines and records. They have been testing questions not necessary to be tested in this suit, and they have utterly failed to test the questions which they will have to test before they can hope to hold these defendants as infringers. Their delay in attempting to test these questions, their delay in bringing suit against these defendants, knowing, as they must, that it would raise questions not raised in the suits which they were prosecuting, and their delay to even notify these defendants that their acts were considered as infringements, has, we submit, forfeited their right to a preliminary injunction.

> "This is not a case of wilful infringement, or of the use of a device identical with the patented one, or a mere colorable attempt to evade it. The correspondents are using a machine, openly made and sold and used under patents, and which, in good faith, the manufacturers have placed in open competition with the machines made by the complainants, honestly believing that they were not trespassing upon any rights of the complainants. This is no defense, if they are adjudged at the final hearing to infringe; but it is a reason why the Court should hesitate to interfere before the final decree in a case where there is no suggestion of any irremediable injury in the intervening time, or of any want of ability to respond to any judgment which may finally be recovered." (Burleigh Rock Drill Co. *v.* Lobdell, 1 B. &. A. 625.)

The financial responsibility of appellants is proved. (R., pp. 55–58.) The harm done to appellants by an injunction would be irreparable. Their business would be wiped out. The benefit to appellees would be inconsiderable.

Here is a case in which Judges Shipman and Groscup have agreed that a certain structure, the ecophone, infringed the patent rights of the appellee. Judge Groscup's *opinion* and *decree* are conclusive to the effect that he did not mean to hold a structure like the Berliner gramophone as coming within the claims of the appellee's patent. Judge Shipman's *opinion* was written to carefully limit the claims in the patent to the structure before him. Excepting a single place in which, by what we consider an unwarranted inference, our opponents urge that he speaks with the language of praise of the reproducer alone, we insist that if Judge Shipman had had before him the Berliner gramophone structure when he wrote the opinion in the Leeds case, he could not have been more careful to limit his opinion to exclude the gramophone from its purview or intent. **Our opponents are forced to disregard the opinion and decree of Judge Groscup and to substantially disregard the entire opinion of Judge Shipman, including the last sentence, in which it was directed that the decree of Judge Groscup should be followed. Our opponents are forced to rely solely upon the decree which Judge Shipman signed. This, in itself, we insist, places their case on such a narrow margin that a preliminary injunction would be grossly unjust and inequitable.**

These appellants are not copyists. They are independent inventors whose inventions are as fundamental as those of the appellee. They are honest, and have acted in good faith, and have no less authority than an opinion of appellee's own general counsel that their invention, as a whole, at least, does not infringe the Bell and Tainter rights.

We have here a case in which indisputably one Court only has done anything which might hold these appellants as infringers. The opinion of that very Court refutes the charge. The decree alone is relied on to touch us. Even then

inferences are necessary. We have shown how unwarranted such inferences are. But even if they be sound, it still remains a fact that the questions raised here for the first time are substantial and vital, and have never been adjudicated. They have never been in the mind of any Court; much less have they been decided by any Court.

These appellants stand here representing a large industry, stretching over this entire country. Their good faith is not impugned. They ask that their rights may be protected and that their case be given the careful consideration which it deserves.

ADDENDUM.

The Mauro affidavit (R., p. 211) refers to a claim of one of Mr. Berliner's patent applications which was rejected on a Suess patent. The Suess patent is owned by the Berliner interests. As appears from the second paragraph on page 18, of the Franklin Institute Lecture (R., p. 190), Mr. Berliner invented the idea of propelling the reproducer by the record, his embodiment of the invention being a carriage mounted on rails. Mr. Suess improved this by substituting a freely swinging arm for the carriage and rails and got a patent for it. When, then, a claim for such arm, by inadvertence, was placed in the Berliner application, it was properly rejected on the Suess patent. We note that it was *not* rejected on any Bell & Tainter patent, showing that the Patent Office saw no conflict. The parts italicised in the Mauro affidavit refer to the fact that in the gramophone the stylus engages the record groove or record tablet under pressure. They do not so engage the undulating record.

The spiral line of the feed-screw in Bell & Tainter accidentally varied from the spiral line constituting the efficient sound record. These spiral lines, at times, by imperfection of the mechanism, varied laterally with respect to each other. Hence the necessity for a loose play, latterly, in the stylus mounting to compensate for the variation of the spiral of the feed-screw from the spiral of the sound record. In the gramophone, the spiral of the screw which propels the stylus is superimposed on and identical with the spiral constituting the median line of the sound record. There can be no lateral variation between these spirals, because they are identical. Hence, the lateral motion of the gramophone mounting has no effect to compensate for non-existing variations between propelling-spiral and sound-record spiral. This is, in effect, admitted by the other side since they withdrew claim 19, which is for the lateral adjustment. In the echophone, the propelling groove is shallow and broad, and the stylus may move laterally therewithin. Its spiral, therefore, does not necessarily coincide functionally with the spiral of the record groove.

VI. Prayer to the Court.

In view of all of these facts, we therefore pray this Honorable Court to reverse the order granting a preliminary injunction in this case.

We ask the Court to hold that claim 21 of the patent in suit, in view of the history of the art, which is apparent from the face of the papers, or in view of Edison's patents, covers not a pioneer invention, but an improvement which, if patentable at all, must be limited to the elements described in the patent effecting the peculiar co-operations there set forth; and to hold furthermore that claim 21 so construed does not cover appellants' device, which is for an independent invention, developed along different lines.

We also ask the Court to hold that claim 21 must on its face be limited to a combination in which the reproducer bears with yielding pressure on the undulations caused by the sound vibrations and constituting the record, and does not, therefore, cover the appellant's device in which the

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This Honorable Court, under the authorities cited in an earlier portion of this brief, has full jurisdiction to make such holding, if on the face of the papers it should commend itself to the Court's best judgment, and thus to dispose, once for all, of the controversy between these parties in so far as claim 21 of the patent is concerned.

In any event, we ask this Honorable Court to overrule the order granting the preliminary injunction on the ground that claim 21 has never been adjudicated as broad enough to cover appellants' device, the only adjudications on the claim having either declared it invalid, or else valid on a construction not broad enough to cover appellants' device.

Finally, we ask that the peculiar equities of the appellants and the laches of the appellees be held sufficient ground for setting aside the order granting the preliminary injunction.

Very respectfully,
GUSTAV BISSING,
Of Counsel for Appellants.

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United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE NATIONAL GRAMOPHONE
COMPANY,
Defendant-Appellant,
vs.
AMERICAN GRAPHOPHONE
COMPANY,
Complainant-Appellee.

APPEAL FROM ORDER
GRANTING A PRELIMINARY INJUNCTION.

BRIEF FOR APPELLEE.

PHILIP MAURO,
RICHARD N. DYER,
Of Counsel for Appellee.

C. G. BURGOYNE, Walker and Centre Street, N. Y.

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United States Circuit Court of Appeals

FOR THE SECOND CIRCUIT.

THE NATIONAL GRAMOPHONE COMPANY ET AL., Defendants, Appellants, v. AMERICAN GRAPHOPHONE COMPANY, Complainant, Appellee.	Appeal from Order granting a Preliminary Injunction.

Brief for Appellee.

This suit is brought on the Bell & Tainter Patent, No. 341,214, granted May 4, 1886, for improvements in method of and apparatus for recording and reproducing speech and other sounds. The invention is embodied in an apparatus familiarly known as the "Graphophone," as well as in the Commercial Edison Phonograph, which is licensed under this patent.

On December 10, 1898, Judge LACOMBE filed an opinion granting a preliminary injunction against the infringement of claim 21. From the order made by the Court pursuant to that opinion defendants appeal.

There is no substantial controversy regarding the facts. The invention of the patent in suit gave life to the now existing art of recording and reproducing sounds. The previous efforts of inventors had not been productive of practical results. The patent in suit, therefore, belongs in the class of pioneer patents.

The papers show that the patent has been sustained after long, arduous and expensive litigation; that defendants began business, while the Leeds & Baldwin case, in this Circuit, was in progress, putting on the market a reproducing machine having as its most prominent operative feature an embodiment of several claims (notably claim 21) of the patent, under a name so closely resembling that of complainant's machine that it is not easily distinguished therefrom by either the eye or the ear.

In order to lessen the labors of the Court and to limit discussion, complainant limited its prayer for relief on this motion to claim 21, which claim *(inter alia)* had been held valid by the decree of the Circuit Court in *American Graphophone Co. vs. Leeds & Baldwin* (87 F. R., 873, SHIPMAN, J.), after consideration of a record of seven hundred pages, containing every fragment of evidence in existence touching the prior art.

Defendants' case is singularly lacking in merit. They are able to advance nothing whatever against the validity of the claim and importance of the invention it covers not presented to the Court in the Leeds & Baldwin case. Moreover, their expert, Mr. Lyons, admits (p. 130, Sec. 29 and p. 136, Sec. 43), that defendants' machine has both the lateral and vertical freedom of movement called for by claim 21, securing the same automatic action by the same means, although he contends that this construction is employed by defendants for a different *purpose, i. e.*, to reproduce sounds from a different kind of a sound-record from that which complainant uses.

Defendants' propositions below were (1) that the decree in the Leeds & Baldwin case should not be regarded as sustaining claim 21 unless there be read into it an additional element, to wit, a sound-record formed in wax-like material, in which case defendants would not infringe; (2) that in defendants' machine the reproducer is not held against the *record*, but against the tablet or *recording material* in which the record is made.

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The first proposition is supposed by defendants' counsel to find some support in certain passages of Judge SHIPMAN's opinion.

The second proposition is based on a refined distinction between the "record" *(i. e.*, the undulating line corresponding to the sound-waves) and the "recording tablet" of device in which the record is made.

Touching the first proposition, Judge LACOMBE held, in disposing of the motion, that claim 21 was expressly adjudged to be valid in the case of this plaintiff vs. Leeds *et al.*, and that there is nothing in Judge SHIPMAN's opinion requiring this Court to read additional elements into claim 21, thereby making it identical with one or more of the other claims, which were also sustained.

It might also be added that it is not permissible to read additional elements into a claim under the leading case in this Circuit of *Perrin vs. Manhattan Railroad Company* (56 F. R., 503), even for the purpose of saving the claim.

Touching the second proposition, Judge LACOMBE found that the word "record" in the patent is not used "to indicate solely that particular part of the recording groove whereon the sound waves are recorded by elevations and depressions." The word "record" is universally used in the art to designate the *tablet* or device which has the sound-record formed therein; but what is more important for present purposes, the object of the particular invention is to insure, *by automatic action*, the constant maintenance of operative relations between the reproducer and the record, and this is secured by leaving the reproducer free to be adjusted and guided by the *material* of which the recording tablet is made. The patent is very clear on this point. It says:

> "The invention consists, ninthly, in having the recorder, of whatever description, or the reproducer, or both, rest against *the tablet or recording material* by gravity."

Judge LACOMBE held that "in defendants' machine this same automatic action is secured in the same way." This is obvious upon inspection of the machine, and is not seriously disputed.

There being no substantial attack upon the validity of claim 21, the only question for discussion is: Do defendants infringe it? In discussing this question we will first explain briefly the invention covered by the claim, and then consider its scope and meaning in the light of Judge SHIPMAN's decision.

This claim is as follows:

> "21. The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described."

The claim covers the "automatic" reproducer, defining the two prominent characteristics thereof. It is comprehensive, and as fully covers defendants' acts as if claims 19-23, inclusive, which were sustained in the Leeds and Baldwin case, were all urged.

Considering the extent of discussion in which appellants have indulged in respect of this claim, the Court will appreciate the labor saved to it by complainant's action in limiting its prayer for relief to this single claim, and will not be misled by the suggestions of appellants' brief as to the motive for this action.

The Automatic Reproducer.

The only apparatus for recording and reproducing sounds which had any bodily existence prior to the patent in suit was the famous tinfoil phonograph invented by Mr. Edison in 1877. In this instrument a sheet of tinfoil was wrapped upon the cylinder, and impressions or indentations produced by the acoustic vibrations of the air were formed on it by a point attached to a diaphragm held in a fixed position. The same point or "style" was used for reproducing the sound, and, its position having been properly determined in the recording operation, it would obviously be in operative relation with the tinfoil surface when the latter was again moved in front of it to reproduce the recorded sound, *provided the tinfoil sheet had not been in the least degree disturbed.* As the machine was not put to practical uses, but was of scientific interest only, this construction answered to illustrate the possibility of mechanically recording and reproducing sounds. The record, however, could not be *removed from the machine* without the destruction of the former as a sound-record, and the operativeness of the reproducing mechanism depended upon *the strict maintenance in reproducing of the exact conditions existing when the record was formed.* So slight a disturbance as a change of temperature and consequent expansion or contraction of the record would throw the reproducer out of alignment and destroy that delicacy of continuous contact without pressure upon the perishable record which was essential to the production of any result.

Bell & Tainter, among their many contributions to the art, introduced the *removable* sound-record, designed to be taken off the machine on which it was made and reproduced on any other machine. This gave rise to radically new conditions. No two machines could be made exactly alike in dimensions. No tablet could be formed with a mathematically true surface, or, if that were possible, it could not long maintain it. Even experts could hardly acquire the delicacy of manipulation (requiring an adjustment to the thousandth part of an inch) necessary to place and maintain the reproducing stylus in its proper operative position with respect to the minute sound-groove, and such adjustment when obtained would be destroyed by the slightest irregularity in the surface of the tablet or in the operation of the machine. Bell & Tainter met these new conditions by the most beautiful mechanical conception that has been introduced into the art since the invention of the original phonograph. They conceived that if the reproducer support were mounted on a universal joint and left free to move both laterally and vertically, it would automatically maintain operative relation with the sound-groove despite all irregularities in the machine or tablet.

This invention, so far as the art has advanced to-day, has proved absolutely indispensable to the construction of a practical talking machine.

It requires some little attention to grasp clearly the nature of this invention and the purposes it serves. It must be remembered that the sound-record contains *irregularities of two sorts: First,* those infinitesimal sinuosities which represent the recorded sounds; *second,* the grosser, yet often minute, irregularities of construction, due to the impossibility of attaining absolute precision and uniformity. It is essential to the reproduction of sound that the stylus and diaphragm should *respond fully* to the first kind of irregularities, and *not at all* to the second kind. Conversely, the support for the reproducing style (that is, the arm which carries the style) should be *virtually rigid to the first kind of irregularities, while perfectly mobile to the second kind,* so as to adjust itself to eccentricities of curvature or departures, however slight, from a true plane surface on the tablet.

No such mechanical problem as this was ever before presented or could possibly arise, save in an art where the operative forces and movements are on the infinitesimal scale of acoustical vibrations.

The reproducer invented and patented by Bell & Tainter is so constructed that the supporting arm automatically engages and tracks the record, moving up and down and from side to side, accommodating itself to all irregularities of the second kind. At the same time the inertia of this arm is so enormous relative to the minute irregularities constituting the sound-record that, in respect to these, it is virtually rigid, so that the movements generated thereby are fully impressed on the diaphragm.

It will be observed that this particular invention has nothing to do directly with the conversion of the irregularities of the record into sound-waves. That result is accomplished by causing the style to rub against and along the undulating line constituting the record. This method of reproduction was invented by Mr. Edison and patented in 1878 (Rec., p. 161). It forms no part of the invention of the patent in suit. *In complainants' machine and in defendants' machine, and in every other that was ever put into use, this Edison method of reproduction has been employed.*

It manifestly makes no difference whether the record undulates from side to side, or up and down. Edison's first patent, referred to above, describes both sorts of records. We call attention to this because defendants make much of the circumstance that their record is a *lateral undulatory* line, while complainants' patent mentions only the *vertically* undulating record. In the one case, as in the other, the sound-waves are reproduced by the style rubbing along the sinuous wall of a groove according to the Edison invention of 1878; and in both cases the style is kept *automatically in operative contact with the sound-groove* by the Bell & Tainter invention of 1886.

By limiting the discussion, on this motion, to claim 21, it becomes wholly immaterial to consider the differences between complainants' sound-record and that of defendants. Claim 21 does not include a sound-record as an element; but, in considering the contention that a particular kind of sound-record—namely, one formed in wax-like material, should be read into the claim, it will not be amiss to point out that, in producing the result of this claim the material composing the tablet is a matter of absolute indifference, so long as it be firm enough to support the weight of the reproducing arm, and guide it properly. This fact is clearly stated in the specification in a passage quoted by Judge LACOMBE. Defendants' special form of record (the laterally undulating groove etched in metal and then transferred to rubber or similar material) was well-known at the date of the Bell & Tainter Patent. Their specification states that the particular improvement under consideration is to be employed in connection with a record *in the form of a groove*, and particularly a groove *with sloping walls*, and adds, "but it may also be usefully employed in connection with other forms of record."

Defendants, as is admitted, employ a record *in the form of a groove with sloping walls, so that even if claim 21 were limited by reading into it that particular form of record for which the specification says the automatic reproducer is "specially adapted," defendants would not be benefited thereby.*

Defendants' Infringement.

It has been pointed out by complainant's experts, and is not disputed, that defendants' machine here is mechanically identical with that of the defendants in the Leeds & Baldwin case. The automatic lateral and vertical adjustments are secured by mounting the reproducer arm on a universal joint, the invention of Bell & Tainter being thus appropriated, however narrowly that important invention be regarded. About this there can be no question at all, and the contention of non-infringement is based, as already stated, on the theory that claim 21 should be construed as covering the Bell & Tainter automatic reproducer only when used in connection with a record formed in wax-like material, or when otherwise limited to some specific peculiarity which defendants have not seen fit to imitate.

No reason not already considered and disposed of by Judge SHIPMAN in the Leeds and Baldwin case is given why the Court should thus by violence alter the scope of the claim, and there are controlling reasons of law and logic why this cannot be done. Its own clear terms and the plain language of the specification alike determine its meaning, by which the Court and the parties are equally bound.

There is no substantial pretense that the claim, construed according to its plain meaning, is anticipated by anything in the prior art.

Much has been said about the existence of a "doubt" touching the patentability of this great invention. But a legal doubt does not exist or arise except upon a showing of something adequate to produce it; and de-

Raymond R. Wile Research Library

fendants are able to produce nothing at all to raise a doubt. Had they done so we should say that when a patent has been sustained, after strenuous litigation, and is approaching the end of its term, doubts are resolved in favor of the patent until they are proved to be legal certainties at the final hearing.

Defendants seem to suppose from certain passages in Judge SHIPMAN's opinion that he had doubts of the patentability of the automatic reproducer except when coupled with a record engraved in wax. The final decree sustaining claims 19, 20 and 21, which are for the reproducer *per se*, as well as claims 22, 23 and 24, which are for the combination of a reproducer and a sound-record, disposes effectually of that supposition; but we propose to comment upon that opinion at large, to show that it contains nothing inconsistent with the decree, which is the final finding and adjudication of the Court, but, on the contrary, clearly supports that decree.

Judge Shipman's Opinion.

The main difference between the Leeds & Baldwin case and the present case is that the infringement of Leeds & Baldwin extended somewhat further than that of the present defendants. The machine of the former was especially designed and intended for use with a record "formed in wax or a wax-like material," although they themselves did not make sound records, but purchased those made by complainant. They therefore (under the doctrine of contributory infringement) infringed claim 24, which was for the combination of such a record with "a reproducer having a rubbing style for receiving sonorous vibrations from said record."

The gramophone is *not* designed for use with a record "formed in wax or a wax-like material," the records made and sold by defendants as part of their apparatus being formed in rubber. Hence they do not infringe claim 24. They do, however, make and sell a "grooved tablet or other body having a sound-record formed therein" (claim 22) and a "tablet or other body having the sound-record formed therein as an irregular groove with sloping walls" (claim 23).

The meaning and scope of all these claims are clear, but if there were any uncertainty about it the specification would remove the doubt. Under the head of "fourthly" it states that the invention consists in "loosely mounting the reproducing style so that it can be readily guided by the record;" and under the head of "ninthly" it states that it consists in having the reproducer "rest against the *tablet* or *recording material* by gravity." Claims 19, 20 and 21 exactly correspond in scope with these statements of the invention.

The specification further states that "the reproducing style, mounted as just explained, is specially adapted for use in connection with a record in the form of a groove with sloping walls, and *this combination is specially claimed*; but it may *also be usefully employed in connection with other forms of record*."

Here is a definite, unambiguous statement that the patentees claimed the reproducer, mounted as explained, both broadly, *i. e.*, in connection with *any kind* of a sound record, and specifically in connection with a record in the form of a groove with sloping walls. These claims are in the patent, and they are either valid or invalid, as to which Judge SHIPMAN's decision must control for the purposes of this motion.

As to the validity of claims 19 to 24, inclusive, which are all clear and definite, the Circuit Court adjudged and decreed in the Leeds and Baldwin case (Rec., p. 21), that the Letters Patent No. 341,214 are "valid so far as claims 19, 20, 21, 22, 23 and 24 are concerned." And the Court further adjudged that the defendants had infringed these claims

> "by the manufacture, use and sale of machines adapted to reproduce sounds from *a grooved tablet or other body having a sound record formed therein*, substantially as described in said letters patent."

If, upon reading Judge SHIPMAN's opinion, without any light other than the document itself affords, any parts of it be found difficult to comprehend, such parts will be made perfectly intelligible by a brief explanation of the issues in the Leeds and Baldwin case. The opinion, however, in all respects pertinent to this motion, is entirely free from obscurity.

In the Leeds and Baldwin case infringement of three distinct sets of claims was urged and found. They were:

1. The loosely mounted or automatic reproducing mechanism, simply, *i. e.*, claims 19, 20 and 21.

2. The loosely mounted reproducer combined with a sound record in the form of a *groove*: *i. e.*, claims 22 and 23. (Claim 23 has the additional limitation that the groove shall have *sloping walls*, to which the reproducer is "specially adapted.")

3. The sound record formed in wax or *wax-like materials* combined with a rubbing style for rubbing over the record; *i. e.*, claim 24.

It is especially noted that in claim 24 the *loose mounting of the reproducer is not an element.* It covers broadly the wax record with *any sort* of rubbing style for reproducing.

Judge SHIPMAN said of this claim:

> "The declaration in the specification that 'no one has reproduced sounds from a wax record by rubbing a style or reproducer over it' *is true*; and it is furthermore true that this combination first shown in the patent in suit, either in method of operation or in the character of the results, converted the noteworthy but short-lived instrument of Edison into a machine of widespread use and of permanent utility."

The Leeds and Baldwin case, therefore, presented the question of infringement of three sets of claims, of which the second and third were combinations of two elements—to wit, (1) a reproducing mechanism and (2) a sound record. Defendants there made no sound records, therefore, to hold them as infringers of these claims (22, 23 and 24) it was necessary to bring the case within the doctrine of contributory infringement. Moreover, since claim 24 was for the combination of a record formed in wax with *any kind* of a rubbing style, however mounted, the patentability of complainant's sound-record was also in issue, the "rubbing style" having been patented by Edison.

Defendants here are in a different situation in this respect, that they *do* make and sell a sound-record, but their sound-record is *not* formed in wax or wax-like material. It follows that they do not infringe claim 24, and all questions touching that claim, which occupied a conspicuous place in the Leeds and Baldwin case, are eliminated. It also follows that the question of contributory infringement is likewise eliminated, and there remains upon this motion only the simple question:

Does their reproducing apparatus embody the subject matter of claim 21?

It will be seen on studying Judge SHIPMAN's opinion that these distinct questions of infringement are separately treated.

After stating briefly the condition of the prior art, the learned Judge referred to the history of the inventive work of the patentees, beginning in 1881, and to two notable results thereof. *First*, the record *engraved in a wax-like substance*, and *second*, the loosely mounted reproducer, "so loosely mounted that, resting against the recording material by gravity, it was *guided by the record*, and followed all the elevations and depressions in the grooves." Each of these, he truly says, is a necessary part of the invention.

He then points out that the dual character of the invention is important "*if it should be held that the reproducer alone*, though novel, is not patentable."

This presented two questions to be decided in that case:

(1) Is the novel reproducer *per se* a patentable invention?

(2) Is the combination of such a reproducer with a particular sound-record patentable?

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If he found on the first question in the affirmative, claims 19, 20 and 21 would necessiarly be sustained; if in the negative they would be found void.

Claim 24 is first treated, the defense being that the claim is void "because sound-records formed in wax, or in wax-like material, were old in the art of reproducing speech, and stress is laid upon Edison experiments."

The evidence is discussed, and the patentable novelty of this sound-record is found as a conclusion. With this portion of the opinion we have nothing to do in the present case, except with the concluding statement that "*each member* of the combination was new, the result was new, and was not obtained by the application of an old device to a similar subject."

Claims *19, 20 and 21* are then discussed, the main defense to which was anticipation by a prior British Patent of Edison's, which was alleged to show "a reproducer, capable of automatically adjusting itself to the record groove, and loosely mounted after the general plan of the patented invention." This patent is referred to as containing some of Mr. Edison's "surmises and beliefs in regard to what could be or might be done," and "some of the suggestions and sketches of various sorts and kinds which Mr. Edison had thought of or had made during his experiments." The learned Judge concludes his examination of this branch of the subject, which directly concerns us in the present case, by saying that "Bell & Tainter made an *actual living invention* which the public can use, and the Court is not called upon to struggle to decipher an anticipation in the unfinished work and the surmises of earlier students of the same subject."

It would be difficult to conceive of a more forceful declaration of patentable novelty than this characterization of the loosely mounted or automatic reproducer as an "*actual living invention*," or to find, in the face of this declaration, any room for supposing that the Court had doubts as to the patentability of the reproducer *taken alone*. In the previous part of the opinion the Court stated that it was a question to be decided whether the "reproducer *alone*, though novel," is or not patentable, and here he emphatically answers the question in the affirmative. He not only held that the Patent Office committed no error in allowing the claims but he bestowed on the invention they cover words of high praise.

It is proper to dwell upon this point, in view of the insistence by the appellants that Judge **Shipman** did not find the self-adjusting reproducer to be a new invention *per se*, but new only when used with an engraved record. If the learned Judge found the invention to be anticipated, and sustained claim upon the inconceivable supposition that it included an engraved record, by what was it anticipated? The only attack was based upon Edison's prior work, and particularly on his British Patent, and the facts of history necessarily restrict the attack to this basis, for *Edison was the only person who ever made, designed or described an apparatus for reproducing sound prior to Bell and Tainter.* Cros' work extended only to the *making* of the record, for reproducing which he proposed to use Edison's means.

We point out at another place in this brief (p. that, as late as 1888, when Mr. Edison began the manufacture of commercial phonographs, *he had no knowledge of the automatic reproducer*, and only discovered the necessity of employing it after a number of machines had been manufactured and sold without it. This fact amounts very nearly to *conclusive evidence* that the automatic reproducer did not exist prior to the patent in suit.

The Court, then, after examining the only alleged anticipations (and appellants here suggest the existence of none other) dismissed them as not disclosing Bell and Tainter's reproducer. It is, therefore, impossible to find a basis for the proposition that the invention of claim 21 was old when Bell and Tainter made it, and that the claim is invalid.

The Court then refers to the doubt expressed by Judge **Grosscup** in the Amet case that the reproducer, though novel, was patentable, and quotes from the

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latter's opinion. He immediately adds: "*I* think it may be that the improvement in the reproducing style is *more* than the mounting of an old style upon a universal joint," giving reasons for not assenting to the specific criticism which Judge Grosscup had made.

The respect (indicated by the moderation of the language used) for the views of Judge Grosscup is plainly but a manifestation of judicial courtesy, and will not be misunderstood or taken as indicative of any doubt in the mind of Judge Shipman touching the patentability of the self-adjusting reproducer, *per se*, as to which he had declared himself in most emphatic terms. In the *broad* view he found and held that Bell and Tainter, in this self-adjusting reproducer, had made an "actual living invention which the public could use." He then proceeded, in a very delicate and considerate way, to show that, even in the *narrow* view of this invention, as the mere adaptation of an old device (the universal joint) to a particular use, nevertheless the improvement would, in his opinion, still be patentable, since the style needed, not only a lateral motion, but also a yielding pressure on the tablet.

It is to be noted that Judge Grosscup *did not pronounce a judgment upon claims 19, 20 and 21.* He merely intimated a *doubt* as to their patentability, and it does not appear that he had given any special consideration to that question. He passed it as unimportant because he found infringement of other claims. Had he pronounced an adverse judgment on them that judgment would have been embodied in the decree.

He left the validity of these claims, *per se*, an open question which was fully considered and decided by Judge Shipman, after a most elaborate presentation. The decree entered by the latter *did* pronounce a judgment upon these claims. They were expressly adjudged to be valid and the opinion declared that they covered an "actual living invention."

We urge that the results of the Leeds and Baldwin case should be taken as conclusive here, as they were in the Court below, because the present record on both sides is prepared on that theory and does not contain the evidence upon which a review of Judge SHIPMAN's findings can be based.

Referring still to the same paragraph of Judge SHIPMAN's decision, we find in it that he fully agrees with "Judge GROSSCUP's idea of the patentable character of the *combination* which appears in these claims" (22 and 24), although he disagrees with him in his view as to the doubtful validity of claims 19, 20 and 21. He further concurs with Judge GROSSCUP that

> "Any device which combines the reproducer described in claims 19 to 24 with *the grooved tablet or other body having a sound-record as described* in the patent, and especially in claims 22 and 24, is an infringement of the patent in suit."

Now, the sound-record "as described in the patent," for which this reproducer was *specially designed*, and in connection with which it is *specially advantageous*, is a sound-record in the form of a *groove* (as distinguished from the raised records or records in the form of a ridge), and in particular one in the form of a *groove with sloping walls.* This is *exactly the form of record which defendants employ.* Their peculiar form of groove *(i. e.*, the zig-zag*)* was well known in the art at the date of the patent in suit, being fully described in the communication of Ch. Cros to the French Academy of Sciences in 1877 and in his French Patents of 1878, in Edison's first patent, as well as elsewhere in prior literature. What these defendants have done is, *first*, to appropriate the patented mechanism (claim 21); *second*, to use it in combination with one of the old species of that particular class of sound-records for which the patent declared it to be specially applicable, and in a combination which is "specially claimed" (claims 22 and 23).

Manifestly, this particular reproducer has no special virtue or utility in connection with a record formed in *wax or a wax-like* material. It works with one material in precisely the same way and with the same results as with another material, so long as the latter is sufficiently hard to resist the weight of the reproidge SHIPMAN's

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ducer and its mounting, and to guide the style. Whether the material be wax or rubber is a matter of absolute indifference in this connection; and, from this consideration alone, it follows that, if it be an infringement to use the reproducer with "a grooved tablet or other body" of *wax*, it must equally be an infringement to use it with a grooved tablet or other body of *rubber*.

Moreover, the patent nowhere intimates any special relation between this peculiar reproducer and a *wax* record. On the contrary, wherever this reproducer mounting is mentioned in connection with a record, it is with a record in the form of a groove, and particularly a groove with sloping walls. On the other hand, in claim 24, where *wax* is mentioned, it is not in connection with this self-adjusting reproducer, but with simply "a rubbing style."

If, therefore, we go no further than the points on which Judge SHIPMAN and Judge GROSSCUP were fully in accord, we find that the present defendants clearly infringe claims 22 and 23; and, if claim 21 is to be limited by reading into it the particular form of sound record for which the reproducer is "specially adapted," it would become coextensive in scope with these claims, which would not help the defendants.

The next passage of Judge SHIPMAN's opinion is not entirely clear, but it is certainly of no importance for present purposes. Having stated what was Judge GROSSCUP's view of claims 22 and 24, and that claim 23 was not in the Amet case, he adds:

> "This construction is not so broad as that which the solicitor for the patentees apparently hoped for, but it limits the claims to the improvements which, in combination, created the new machine and which are abundantly described in the specification."

Whether by "this construction" the learned Judge meant the construction of claim 23, which is the direct antecedent, or the construction placed by Judge GROSSCUP on claims 22 and 24, which is the subject under consideration, is doubtful. Assuming the latter, we must say that we do not know where it appeared that either the solicitor for the patentees who drew the specification, or the solicitor in the suit, hoped for a broader interpretation of claims 22, 23 and 24. Be that as it may, we would make three observations which seem pertinent :

1. The learned Judge is referring here only to the *combination* claims, and from his remark no inference can be drawn that he had any doubt of the patentability of the self-adjusting producer *per se*, as to which he had so emphatically expressed his conclusion in the words already quoted.

2. The learned Judge is not here stating his own conclusion, but merely the conclusion of Judge GROSSCUP, and what its effect would be. There is no implication that he does not himself take a broader view of the invention than Judge GROSSCUP, and the contrary appears at several points in the opinion.

3. The construction of these claims here referred to clearly embraces the acts of the present defendants.

The learned Judge then comes to the question of infringement, and describes defendants' machine, which is, in construction and operation, practically identical with defendants' machine in the present case. Touching claims 19, 20 and 21 the Court said :

> "So far as the *reproducing device is concerned*, there is *no substantial controversy in regard to infringement*, but it is said that defendants do not infringe claims 22, 23 and 24 because they neither make nor sell the sound-records, but simply sell this reproducing device to be used as the purchaser chooses."

It follows that in the present case likewise there is no room for controversy touching the infringement of the reproducer claims 19, 20 and 21, for the machines are practically identical ; nor is it open to these de-

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fendants to make the contention regarding claims 22 and 23 on which the defendants in the Leeds and Baldwin case relied, for the present defendants *do* make and sell both elements of the combination of these claims ; to wit: (1) " A grooved tablet having a sound record formed therein," and (2) a reproducer having a style mounted on a universal joint, and free to move laterally so as to adjust itself to the groove.

It is obvious that the last-quoted passage in the opinion absolutely precludes the idea that any doubt rested in Judge SHIPMAN's mind touching the patentability of claims 19, 20 and 21, or any idea that they were or could be read so as to embrace a *wax record* or any particular record as an element.

The Court then applies to the case before it the doctrine of contributory infringement, which is not a feature of the present case. Finally, the Court says :

> " I do not think that the improvement described in claims 37 and 38 possesses the element of patentable invention."

If that were what he thought of claims 19, 20 and 21 it is reasonable to suppose he would have said so, and his decree would have treated these claims as claims 37 and 38 are treated.

Defendants' Equities.

This point is not logically reached for discussion until it is ascertained that defendants are using complainant's property without its consent. If defendants are *not* infringing, they do not stand in need of the indulgence of the Court.

The question then is this: Defendants having for over a year enjoyed the use of complainant's property, and having profited largely thereby, does the case present any special reason why they should be permitted to *continue* such use, without compensation, until a decision at final hearing be reached ?

The reason advanced by the defendants is that the complainant has been guilty of laches in not sooner bringing this suit.

On this point the Court below held :

> " There seems to be no special equity in the circumstance that defendants have not heretofore been disturbed by suit ; complainant has evidently been diligent in bringing suits against earlier infringers and was under no obligation to sue every one at the same time."

The Court here followed the uniform rule in such cases.

Colgate vs. Gold & Stock Co., 4 B. & A., 425.
Van Hook vs. Pendleton, 1 Blatch., 187.
Rumford Chem. Works vs. Vice, 14 Blatch., 181.
Green vs. French, 4 B. & A., 169.
Edison E. L. Co. vs. Sawyer-Man Co., 53 F. R., 597.
Id. vs. Mt. Morris Co., 58 F. R., 572.

The gramophone business was created by the defendant company, which came into existence in October, 1896. At that time the Leeds and Baldwin suit was pending, and on November 16, 1896, Judge LACOMBE denied a motion for preliminary injunction based on Judge GROSSCUP's opinion. This motion was renewed in January, 1897, after Judge GROSSCUP had made his decree final, but was again denied by Judge LACOMBE on the showing that the validity of the claims involved would be attacked upon a great mass of evidence not considered by Judge GROSSCUP. This was a notice to the complainant from this Court that it could have no relief until after the final decree in the Leeds and Baldwin case. The latter was, therefore, conducted as a test case, and its progress and result were known to every one interested in this business. Defendants were well informed of it. As soon as the final decree was entered the present suit was brought.

The delay, however, has worked no hardship to defendants. On their own showing they have made good use of it, making and distributing among themselves

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large profits. Complainant has correspondingly suffered, and has been the only sufferer. This state of facts presents no reason why defendants should be allowed, for another indefinite period, to use complainant's property without compensation.

It is suggested in appellants' brief that complainant can recover after final hearing. The Court knows that the possibility of recovering after tedious accounting is *never* an adequate remedy. The only remedy to the patentee is the security of that right which his patent purports to give--namely, the *exclusive* enjoyment of his invention. This patent has now but four years to run. It has been established, after severe and expensive litigation, and is recognized as having given existence to an industry of great importance. That period of four years is surely a short enough time to allow the patentees of so great an invention. Any different conclusion would mean that the remainder of the term of the patent must be consumed in litigation.

Moreover, the defendant company, and all its belongings, could disappear in a night, and the possibility that it will preserve its gains to satisfy complainant's claim is a very remote contingency.

Even if the affirmance of the order below would work great hardship (and it is not a hardship for an individual to be disappointed as to *expected* gains to which he is not entitled), that fact would offer no reason for withholding the injunction.

2 High on Injunction, 729.
Hodge vs. Hudson River Co., 6 Blatch., 170.
Brown vs. Deere, 6 F. R., 491.
Potter vs. Fuller, 2 Fish., 251.

These authorities are all to the same effect. It will suffice to quote the last:

> "Where the validity of a patent is fully established and the infringement is clear, a party has a right to protection by injunction, although *it may cause great injury to the infringer.*"

The Allegations of Error.

1. The first ground of alleged error is in general terms.

2, 3. Error is alleged in that the Court construed claim 21 in accordance with its own understanding, instead of in accordance with prior adjudications. We submit that the interpretation placed upon the claim by the Court is entirely in harmony with prior adjudications, and the only one of which the claim is susceptible.

4. Error is alleged in deciding matters of difference and similarity, as involved in the question of infringement, upon *ex parte* affidavits. It is not seen how such matters can be decided on an injunction motion except upon *ex parte* affidavits. The reproducer mounting of the gramophone is admitted to be mechanically identical with the "echophone," adjudged to be an infringement in the Leeds and Baldwin case.

5. It is alleged that the histories of the two inventions—evolved and developed from different sources—create a presumption that there is no infringement. The appeal to history is delusive. The question of infringement is one of substantial identity in construction, operation and result of certain physical things, which are before the Court, and this question is to be determined by a comparison of those things, regardless of the history of their evolution.

Moreover, the assumption that the *reproducing* mechanism of the gramophone is an evolution from the invention of Cros is contrary to fact. The idea of Cros which Berliner developed was the etched sound record. When he had evolved that to a point of practical utility he had to choose between *two known forms of apparatus for reproducing the sounds*— one the rigid reproducer of the old art, the other the automatic reproducer of Bell & Tainter. Mr. Berliner

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chose the latter. He did not evolve or develop, but simply took it.

6, 7. These allegations deal with defendants' supposed equities, which call for no further discussion.

8. Error is alleged in construing the word "record" in the claim in accordance with its general meaning in the art, and in accordance with what the purpose of the claim calls for—namely, that the stylus shall rest freely upon, so as to be guided and controlled by, the material of which the record is composed.

If insistence upon the alternative and narrow meaning of the word "record" were proper, defendants would not profit, in the absence of all doubt that they accomplish the purposes of the invention by substantially the same means. The finding of infringement by the Court below is based on this statement of fact:

> "*And in defendants' machine this same automatic action is secured in the same way.*"

It is elementary law that, when this state of facts is found, infringement is the inevitable conclusion. **Appellants Take No Exception to This Finding of Fact.**

9. It is not error to assume the validity of a claim that has been adjudged valid. The Court is bound so to do, *except upon such a showing by new evidence as satisfies the Court that the prior adjudication was erroneous.* In this case there is no new attack upon the validity of the claim.

10. This is a restatement of matters already considered.

11. The reproducer arm in Edison's patents has *neither* lateral nor vertical freedom of motion. It is positively held and guided, and is not supported, controlled, guided or adjusted by the record.

These patents have been considered in *every previous case.*

We do not think that any one of these eleven allegations will commend itself to the favor of the Court.

Appellants' Brief.

Appellants have filed a very long brief, which is mainly occupied with a laborious effort to obscure and explain away the obvious, pertinent and controlling facts. No matter from what point the argument starts, it leads up finally to the position that defendants use the *etched* record of Ch. Cros, and not the *engraved* record of Bell & Tainter. Defendants are charged with making an infringing *reproducer*. Their plea in confession and avoidance is that, while this may be true they do not use the patented *sound-record*. The whole argument is practically a confession that defendants infringe, unless the Court, contrary to the unalterable terms of the claim, and contrary to the explicit statements of the specification, limits the claim to the specified invention only when used with a record that undulates vertically, or to one engraved in wax.

We shall not attempt to follow the lines of reasoning pursued in appellants' brief, it being sufficient to point out that the arguments there presented are without foundation. A necessary basis for the contention that claim 21 should be construed to include a sound-record of a specific construction, which defendants do not use, would be a showing that the reproducer, invented and patented by Bell & Tainter, was old in the art *except* in the narrow combination with an engraved record. Even in that case, we think the Court could not narrow the claim by altering and adding to its plain terms (particularly as it would thereby become identical in scope with other claims), but would be constrained to declare the claim invalid for want of novelty.

Defendants' brief below (pp. 30, 31) admits that their reproducer has the same functions of automatic *every previous*

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lateral and vertical adjustability, thereby insuring automatically the operative position of the reproducer, and it was contended that in these features the device of complainant employed merely ordinary unpatentable means of providing for lost motion. These admissions are very clearly made in the argumentative affidavit of Mr. Berliner's patent solicitor and expert, Mr. Lyons. On page 130 he says:

> "(29) As a matter of fact, both in the Graphophone and in the Gramophone the *diaphragm with its stylus is mounted upon an arm that is hinged in such manner that the stylus can come in contact with the bottom of the groove.*"

This refers to the *vertical* freedom of movement. On page 136, referring to the *lateral* freedom of movement, he says:

> "(43) As a matter of fact, the arm which carries the diaphragm box with its stylus in the Gramophone *is* hinged to have freedom to move horizontally—not within the space of one-twentieth of an inch as in the Phonograph, but all over and beyond the face of the record disk."

In other words, it has all the lateral freedom of movement which he calculates is necessary to secure the purpose of the invention, *and considerably more.*

It then being obvious and undisputed that defendants' machine employs the precise construction of the claim, and embodies its operation, there remains no ground upon which this motion can be resisted, except by showing that the claim is *invalid*, and the invention it covers *old*. Defendants' counsel recognize this in their brief filed in this Court, where an effort at suggesting an anticipation is made. On page 54 it is stated, in large type, that claim 21 as construed by the Court below, is in essence for "a combination by which the tracking of a rod or stick in a groove is effected by a yielding pressure and by a universal joint, to compensate for such irregularities as all grooves constructed by human machinery are subject to;"

and it is suggested that, so construed, the claim is anticipated by "a small boy who carries a stick in his hand, and as he walks along the street sees a crack or crevice in the pavement," and trails "the stick along behind him, keeping the point always in the groove."

Notwithstanding that this argument is soberly made, and it is pointed out with an appearance of seriousness that the hand of the small boy is an "universal joint," we do not think the learned counsel expect the Court to accept this small boy with his stick as an anticipation. Patent rights and property are not disposed of upon fanciful and far-fetched analogies, but upon consideration of the *old means* that existed in the art, of the *new means* introduced by the patentee, and of the *new industrial results* thereby attained. Nevertheless, this bit of imaginative work will enable us to state distinctly the issue which the Court has to decide.

Defendants' argument has now brought them to this position: they concede that they *do* employ the construction specified in the claim and to the same end; but they contend that if the claim be construed to cover that which it explicitly defines, it should be adjudged *void on its face, as upon general demurrer, in view of matters (e. g., small boys with sticks) whereof the Court takes judicial notice.*

We have, then, to deal with the contention that the claim is void on its face. This contention ignores totally the ingenious conception involved in the invention, the obscure and baffling conditions of this art, and the importance of the new results attained by the invention. Particularly does it ignore the condition of providing automatically for two sorts of irregularities—both miscroscopical—to one of which the reproducer must at all times absolutely respond, and to the other be at all times absolutely irresponsive. This condition, which exists in no other mechanism, has already been explained, and enough has been said about it. Small boys with sticks did not solve the great and intricate problems solved by the automatic reproducer, and the suggestion will not help the defendants.

A conclusive answer to the contention that claim 21, if construed according to its terms, would be anticipated by matters of common notoriety, is found in the history of the art since the date of the patent in suit. The reproducer of the prior art was held in a rigid support, and its disadvantages (which rendered it incapable of practical use) have been pointed out. It is asserted (Devine, p. 14) and not disputed, that the automatic reproducer of Bell & Tainter "is indispensable to a practical talking machine." In the Leeds & Baldwin case it was shown that the automatic reproducer has been *universally employed* since its invention by Bell & Tainter.

The one apparent exception to the universal employment of this invention in practical use emphasizes the conclusions we are here drawing. In the Leeds & Baldwin case Mr. Edison was put on the stand as a witness for the defendants, and he testified that in the first commercial phonographs manufactured by his company (1888) he employed a reproducer rigidly supported, as in the old art; that he found at once that this construction was faulty and impractical, to such extent that he not only introduced the self-adjusting reproducer on all subsequent machines, *but recalled and changed in this respect those that had been marketed without that feature* (p. 256, x-Qs. 24-26, Leeds & Baldwin Rec.).

In view of these facts a general demurrer to claim 21 could hardly be sustained.

In Maitland vs. Archer and Pancoast Co., 72 F. R., 660-664, Judge Coxe said:

> "It is not an unreasonable presumption that one who succeeds in doing what so accomplished an inventor as Edison failed to do is on a distinctly higher plane than a mechanic. Not only did Edison fail himself, but he was among the first to recognize the merits of the invention, practically as well as theoretically, for his firm took a license under Stieringer's patent."

Defendants' counsel also assert that Edison's English

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Patent of 1878 anticipates the reproducing instrumentality of claim 21 of the Bell & Tainter Patent, and makes necessary the limitation of that claim to the combination of such instrumentality with the peculiar sound record. It appears from Judge SHIPMAN's opinion in the Leeds and Baldwin case that he considered the Edison Patent in connection with claims 19, 20 and 21 of the Bell & Tainter Patent, in view of the defendants' contention that the Edison Patent discloses

> "a reproducer capable of automatically adjusting itself to the record groove, and loosely mounted, after the general plan of the patented invention."

Judge SHIPMAN failed to find a disclosure of that invention in the Edison Patent, characterizing that patent as "confessedly vague" and finding that Bell & Tainter had made, in respect to the reproducer,

> "an actual living invention, which the public are able to use."

Defendants' counsel say that Judge SHIPMAN's attention was not particularly directed to figures 1 and 2 of the Edison Patent, and it appears from Judge SHIPMAN's opinion that figures 27, 34 and 37 were those on which the greatest stress was placed in the Leeds & Baldwin case. It is evident, however, that the entire patent was considered by Judge SHIPMAN, and it is further evident that if the automatic reproducer is anywhere disclosed in the Edison Patent, it will be found, not in figures 1 and 2, but in the other figures to which Judge SHIPMAN refers. Edison had taken prior patents on his phonograph, and the general characteristics of that machine had become established. One of these characteristics was the locking of the recorder and reproducer (usually the same instrument) in an adjusted position with respect to the tinfoil surface upon which the sound was recorded. While no special description of the lock is found in the Edison Patent, it is clearly illustrated in figures 1 and 2 as a device operated by a

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handle which appears on the top of the post 6 to which the arm carrying the recorder or reproducer is pivoted at the point 5. In figures 27, 34 and 37 the lock is not shown, because these figures are incomplete illustrations. Therefore, by assuming that no locking device was intended to be used with the recorders and reproducers of these figures, and further assuming that the instrumentalities of these figures are intended to operate on the floating principle, an anticipation of the Bell & Tainter automatic reproducer by the Edison Patent was argued in the Leeds and Baldwin case. However, since Edison did not say that he omitted the lock and introduced this new principle into the operation of the recorders and reproducers of these latter figures, the Bell & Tainter device could hardly be found disclosed in the Edison Patent. Defendants' counsel, however, by ignoring this well-understood characteristic of the Edison phonograph, and ignoring the illustration of the lock in figures 1 and 2, now argue that those figures disclose the Bell & Tainter device. The Edison Patent, in its general description, refers to the adjustment of the recorder and reproducer to a definite position. At line 14 of the complete specification (R., p. 196), referring to the recorder it says:

> "The phonograph [recorder] is adjusted to position with its indenting point contiguous to a moving surface," etc.,

and referring to the reproducer (line 24, same page) it says:

> "It is similar in construction to the phonograph [recorder] * * *. The sounds are reproduced by the phonet [reproducer] being adjusted to place," etc.

Nowhere does the patent suggest that the recorder or reproducer shall rest by its weight on the surface, and adjust itself automatically to that surface, as does the Bell & Tainter device.

To pursue the argument of defendants a little further, it is contended that in the graphophone the self-adjusting reproducer does *something more* than provide for irregularities in the sound grooves—namely, it enables the stylus to slide down the sloping walls of the groove, and thus rest on the bottom thereof. This action, it is said, does not take place in the gramophone, because the walls of the sound groove are *not so sloping* as in the graphophone record. It is urged that this further result is the new and patentable thing.

The merit of this contention would be a proper subject of discussion in connection with claim 23, which has as one element a sound record formed as "an irregular groove with sloping walls." Assuming, however, this discussion to be relevant, the facts are these: It is manifest that the ideal position for the stylus is in the mathematical axis or centre line of the groove, since it will there encounter the minimum friction, and have the utmost freedom to respond to the undulations representing the recorded sound. It is likewise manifest that this ideal position will be best maintained if the walls of the groove *slope* or converge towards the bottom. Both the graphophone and the gramophone records have this feature of sloping walls. This was proved by complainant's experts and admitted by Mr. Lyons; but the latter says that while the slope in the one case is gradual or easy, in the other it is quite abrupt. The only distinction he can draw is this (R., p. 135):

> "the walls of a gramophone record groove cannot
> " be said to be sloping; they are *too steep* to de-
> " serve this appellation."

As in the case of the lateral freedom of motion, the answer of this ingenious expert and attorney is that the gramophone record has as much slope as the graphophone and *considerbly more.*

If the feature of a sound-record with sloping walls enters into the consideration of claim 21, the evidence of the experts on both sides makes it certain that defendants employ that feature.

Several points of minor importance in appellants' brief call for a passing notice.

(a) Much stress is laid upon an opinion of Messrs. Pollock & Mauro, given to Mr. Berliner in *1891*, and which is cited in support of the contention that the apparatus made by the National Gramophone Company in *1898* does not infringe complainant's patent. If this document contained any facts or arguments which will tend to support defendants' contention, the Court will undoubtedly give them such weight as they may deserve. We suppose, however, that the Court would give them just as much weight when advanced by defendants' counsel as when advanced by the author of that opinion. Or, if the author of that opinion is to be regarded as a supreme authority in this art, we would suggest that his matured views in 1898, after extensive study and experience in the talking-machine litigation, would be safer to rest upon than those entertained in 1891. In fact, however, Mr. Mauro never formed and never expressed the opinion that Mr. Berliner could use the self-adjusting reproducer of Bell & Tainter, without infringing the Bell & Tainter patent. The proposed system of Mr. Berliner, examined and passed upon at the time, was that set forth in his patents of 1887 and 1888, as stated in the opinion. The first patent shows a reproducer held in a fixed position, as in the old art. The second has no drawing and describes *no reproducer at all*. The only asserted novelty in these patents was a process of preparing sound-records, and this was the only subject considered (Mauro's Affidavit, p. 209).

The construction now employed by the defendants is that of the Suess Patent, No. 427,279, and Berliner's 1895 Patent. The description given in one of the original claims of the latter patent was for

> " a reproducing diaphragm and stylus, mounted upon a *freely swinging arm*, having *universal*

> *movement*, and *preponderating at one end*, to maintain the stylus *automatically in engagement* with *the record groove*, whereby the latter *guides the stylus*" (Rec., p. 211).

Thus Mr. Berliner, in describing the construction under consideration, not only sets forth the precise features of the Bell & Tainter reproducer and the functions or results, but sets it forth in almost *the very language* of the Bell & Tainter Patent and claims.

The Suess Patent also speaks directly to the point (pp. 211, 212). It specifies the supporting frame for the reproducer, "*loosely pivoted to swing freely, both laterally and vertically*, and an adjustable counterweight on the frame for determining *the pressure of the stylus on the record tablet.*"

Again we have a description from the defendants almost identical in its terms with that of the Bell & Tainter Patent.

(b) Attempt is made to create the impression that the argument of complainant's counsel in the Leeds & Baldwin case was inconsistent with their present argument, and to support this attempt a passage is quoted (on p. 56) from the brief in the Leeds & Baldwin case. We can hardly expect this Court to read that entire brief to see if this charge be justified or not. We assert, however, that it has no basis. In that case the sound-record was involved as well as the reproducer, but throughout these were treated as distinct inventions. Thus (p. 32), after quoting claims 19, 20 and 21, the brief states:

> "These claims specify the reproducer *per se, without regard to the kind of sound-record with which it is used.*"

That was our position then, and is our position now. Any other position would be manifestly untenable. The two inventions were treated under different headings, while it was pointed out, and is the case, that *both* contributed to the common new result of a practical talking machine.

Raymond R. Wile Research Library

The passage quoted by appellants contains nothing inconsistent with this. It refers to the part which the discovery of the automatic reproducer played in the development of the engraving method, the first method by which accurate and practical results in recording and reproducing articulate speech were obtained. It was proved by Mr. Tainter that the development of this process was at a standstill, and it seemed impossible to progress to a practically useful result with any method of reproduction available. He then detailed (Leeds case, page 188), a series of twenty-six experiments in developing the automatic reproducer and said:

> "These experiments were of a delicate character, and they resulted in the construction of the reproducer described in our patent, and which, as far as I know, has been a feature of every successful and practical talking machine ever put on the market. *All the machines of the present day employ it.*"

Upon this proof, it seemed not too much to say that the chief merit of the automatic reproducer lay "in the part it played in developing the engraving method." It gave the public, as Judge SHIPMAN said, "an actual *living* invention." But had Cros' etching method been under development the result would have been the same. The Bell & Tainter reproducer would have been, and is, equally indispensable.

Defendants are manifestly hard pressed to resort to arguments of this character.

(c) Thoughout appellants' brief the mistaken assumption appears that, in the graphophone sound-record, the undulations are solely at the bottom of the groove, and that the latter has smooth side walls. In fact, the record is cut, as described in the patent, with a style having a *curved* cutting edge, and in practice this curve is the arc of a circle. Hence, the groove is a circular arc, and the record is on the side-walls, as well as on the bottom; and the theory that the

graphophone record requires something peculiar to itself to conduct the stylus to the bottom of the groove has no basis in fact. Much of appellants' argument rests on this erroneous assumption.

Conclusion.

We submit that the appellants have shown no error in the decision of the Court below.

January 19, 1898.

Philip Mauro,
Richard N. Dyer,
Of Counsel for Appellee.

~~important features. It has been said that it is the resemblances that should be looked at, rather than the differences. But the existence of the latter negatives the former, and it is necessary to take both into view, in order to get a correct picture of the whole. Mr. Justice Brown said in delivering the opinion of the court in Coats v. Thread Co.:~~

> ~~"The differences are less conspicuous than the general resemblance between the two. At the same time, they are such as could not fail to impress themselves upon a person who examined them with a view to ascertain who was the real manufacturer of the thread."~~

~~And see the observations of Mr. Justice Lamar in Corbin v. Gould, 133 U. S., at pages 312, 313, 10 Sup. Ct. 312.~~

~~Upon the whole, we are satisfied that at least there was no "plain error" in the order of the circuit court, and it is accordingly affirmed.~~

AMERICAN GRAPHOPHONE CO. v. NATIONAL GRAMOPHONE CO. et al.

(Circuit Court of Appeals, Second Circuit.)

Patents—Preliminary Injunction—Recording and Reproducing Records.
A preliminary injunction against infringement of claim 21 of the Bell & Tainter patent, No. 341,214, which claim covers a loosely-mounted or gravity reproducer in a machine for recording and reproducing speech, *held* to have been granted on a misunderstanding of the scope of a prior decision.

Appeal from the Circuit Court of the United States for the Southern District of New York.

This is an appeal from an order of the circuit court for the Southern district of New York (90 Fed. 824) which granted an injunction pendente lite against the infringement of claim 21 of letters patent No. 341,214, to Bell & Tainter, for the instrument called the "Graphophone." The instrument which was found to infringe is known as the "Berliner Gramophone," and is described in letters patent Nos. 372,786 and 564,586.

Charles E. Mitchell, Howard W. Hayes, Gustav Bissing, and Horace Pettit, for appellant.

Philip Mauro and Richard N. Dyer, for appellees.

Before WALLACE and SHIPMAN, Circuit Judges.

SHIPMAN, Circuit Judge. The Bell & Tainter patent was before the circuit court for the Southern district of New York upon final hearing in a suit of the present complainant against Leeds and others. 87 Fed. 873. The order pendente lite was granted upon the theory that the complainant's construction of claim 21 had been positively adopted by this court in the Leeds Case, and the only question upon this appeal is whether that theory was well founded. It is therefore necessary to ascertain the scope of the decision. The history of the Bell & Tainter invention indicates that it started in experiments to improve the Edison phonograph of 1879, which resulted in the abandonment of Edison's process of indentation upon a pliable material, and the substitution therefor of the cutting or engraving the record in the form of a groove, with sloping walls, in a waxy substance, and also in the substitution, in place of a rigid reproducer, of one so loosely mounted that, resting against the tablet by gravity, it was guided by the record, and followed the elevations and depressions in the groove. The two improvements of importance with respect to claims 19 to 22 were said to be:

> "The new material for a sound record upon which vertically undulating grooves, with sloping walls, were engraved by a cutting style; and the reproducer which rested upon these grooves by gravity, and moving along them, imparted to a second diaphragm the vibrations incident to the elevations and depressions of the bottoms of the groove."

Upon the question of infringement in the Leeds Case, there was no serious controversy. The defendants insisted that sound records formed in wax or wax-like material were old,—an issue which was decided against them. Inasmuch as the court might be of opinion that claims 19, 20, and 21 related merely to the loosely-mounted reproducer, the defendants made the point that such a reproducer, capable of automatically adjusting itself to the record grooves, was also old; but this proposition was not sustained.

Upon the question of the construction of the claims, Judge Grosscup, in the Amet Case, 74 Fed. 789, did not think that the universal joint in the gravity reproducer made it a patentable invention, but that the combination which included the reproducer with the new record—that is, the grooved tablet having the record as described in the patent—was patentable. The circuit judge did not thoroughly agree with Judge Grosscup, and thought that the loosely-mounted reproducer might be patentable by itself; but the case did not call for a decision of that question, and therefore directed a decree in the form adopted in the Amet Case.

Berliner used for his original record plate a zinc plate covered with a thin, fatty film, which, after the film along the lateral line made by the stylus has been removed, is placed in an etching bath. When the groove has been etched, the zinc plate is electroplated with copper, and the plate impresses the sound record into a hard-rubber plate, which has been softened by heat. The hard-rubber plate is the tablet which contains the record. The adjudication in the Leeds Case was not an adequate basis for an order for an injunction pendente lite against the Berliner device, for it relates to the infringement of claim 21 by the use of the dual improvements of Bell & Tainter, and was not intended to go further and decide the status of a device which did not contain a tablet of their new material for a sound record. The order of the circuit court is reversed, with costs.

PALMER v. KNIGHT.

(Circuit Court, E. D. Pennsylvania. February 28, 1899.)

~~1. PATENTS—INFRINGEMENT.~~

~~A claim for a hammock or bed bottom of woven fabric, having suspension loops "formed of unwoven portions of the threads of the warp of the fabric, substantially as herein described," is not infringed by a hammock, in which the suspension loops are formed from the perfectly woven piece of fabric composing the body of the hammock.~~

Argument (Rough) - Howard Hayes'
Argument
Decision

Edison National Historic Site
Legal Boxes.

11 claims

This is an appeal from an order granting a preliminary injunction. The patent in ~~law~~ suit is no. 341, 214 for a sound reproducing machine called the Graphophone. The patent is an old one, but only eleven claims have been ~~claimed~~ sustained in any shape. Six of these claims relate to the subject matter of this suit, viz., the reproducing machinery.

In this case the complainants ask for a preliminary injunction on five of these six claims, but at the hearing below abandoned all but one. Berliner, the scientist &c There can, therefore, be no pretense that the defendants are copyists or flagrant infringers and it is only by a forced construction of the sole remaining claims that any pretense of infringement can be made. The claim in question is no. 21 and reads as follows:

Read claim

> "The reproducer mounted on a universal joint and held against the record by yielding pressure, substantially as described."

Define Record

The word record" appears in this claim and is a vital portion of it. I want to make it clear to the Court just what the record is. We maintain that it is the tangible permanent inscription or undulations made by sound and which is capable of reproducing those sounds.

Difference between the two records - models

I have here a board model which shows the type of record used by Bell and Tainter. As will be seen, the record consists of vertical undulations in the bottom of a groove ~~of~~ with sloping walls, which moves the stylus positively in one direction only. The undulations are most efficient at the center of each groove.

The Gramophone record which the defendants use ~~was invented by Mr. Berliner, the well-known scientist and inventor of the Microphone, and was the result of four years of constant experiment~~. ~~It~~ consists of grooves in hard rubber of con-

stant depth with lateral undulations in each side. These lateral undulations constitute the record and move the stylus positively in both directions.

Function of joint - Pressure contact

Now, with a reproducer used with a vertically varying record of the Bell and Tainter type, which acts positively in one direction only, it is manifestly necessary to have a mounting for the stylus with a downward pressure to act against the vertical undulations. The undulations acting positively upward there must be some other force which acts positively downward and this is the pressure. ~~So to, since the record [illegible] if [illegible] are shallow, and the record is efficient at the center only, a lateral [illegible] in the mounting is necessary to automatically guide the stylus~~

~~to the center of the groove where the efficient record is.~~

(~~[illegible]~~) The universal joint is shown in the patent (record, p.41/fig8) as a piece of rubber tubing 32. The weight of the mounting acting downward through the universal joint is ~~the~~ a positive force, which acts against the undulations which move positively upward.

With the Berliner record, which acts positively in both directions, no pressure against the undulations is necessary or is employed. The undulations are on the side walls. The stylus does not press against them. Raise the stylus and it will still work (illustrate with model.) ~~Nor is there any sh[illegible] to the most [illegible]ent portion of the groove. The stylus [illegible] in one place only.~~

Berliner, no pressure

But it is argued by the other side that the capacity for vertical motion of the Gramophone reproducer acts to compensate for the grosser irregularities of the tablet, not those which cause sound, but such as are due ~~from~~ to the warping of the plate. That argument would require that the word

How do we infringe? Warping

"record" in the claims should mean "record material", as any warping would not be a warping of the record, but of the tablet itself. If the patentees in using the word "record" had meant "record material" or record tablet, they would have said so, as those terms are used in their proper sense in other places in the patent. The word "record~~s~~" can naturally mean nothing but that which is recorded and is the undulations corresponding to sound waves.

~~Sobr~~ "record material"

lost motion device

If the word "record" is construed to mean the "record material", the universal joint of the reproducing device of the patent becomes merely a lost motion ~~[illegible]~~ device, such as is common in all the arts. No one ever builds a machine so tight in its joints that there is not enough play to compensate for irregularities. The claim so construed no longer expresses the function that the stylus shall press positively downward against a record which acts positively in one direction upward only. ~~The complainants by the testimony of their own expert in the Leeds case have therefore, limited until now,~~ ~~[illegible]~~ the scope of claim 21.

not against record

Regardless of any question of function , claim 21 requires the reproducer to be held against the record. That is done in the Graphophone, but in the Gramophone the reproducer is held against the record tablet by pressure and not against the record, as the bottom of the groove in the Gramophone is the tablet itself and not a part of the record. This proves that the defendant can no way infringe claim 21.

Adjudication

The complainant have asked for a preliminary injunction without having a sufficient adjudication on which to base it. The two cases that have been decided bearing on their claim are the Amet case before Judge Grosscup and the Leeds case before Judge Shipman.

The defendants in each of these cases used the Ecophone, which you see here and which employs a cut wax record having undulations in the botton of the groove acting positively in one direction upward only. To declare this machine an infringement, it was not necessary to construe the word "record" in claim 21, to mean either "record groove" or "record material".

Amet case

Xmx, Now, Judge Crosscup, treating the patent, declined to sustain the claim 21, except as the reproducer therein described was used in combination with a record, described in claims 22 and 24, which have been withdrawn. He declined to hold that the reproducer described in claim 21 was patentable by itself.

In the Leeds case, Judge Shipman's opinion goes no further than to sustain the validity of the combination of the Graphophone cut wax record with the reproducer described in claim 21. He was particularly careful to limit his decision to the actual facts before him. The complainants have made no successful attempts to gain any comfort from Judge Shipman's opinion. Judge Shipman's decree seems to hold that claim 21 is valid ~~fmx~~ per se, and on this decree alone, the complainants have based their case. This decree enjoins

Leeds case

a device in which the undulations acts positively in one direction only, and in which the stylus presses against these undulations. We contend that a naked decree is not enough to found an injunction on, since we must go to the opinion to construe the claim.

Injunction on decree without construction

The primary, fundamental and fatal error of the Court below was to read claim 21 in view of the patents specification, instead of in view of the prior adjudication. ~~We have carefully considered the brief of th Appellee and if they have, in any suit, obtained the construction~~ of claim 21, ~~whereby "record" means "record material", or in which the~~

Low court construed claim from spec.

question of pressing against the record material as distinguished from pressing against the record, has ever been considered by any Court, much less decided by it, we should like to know it. So long as record in claim 21 means undulations, the claim has a special reference and co-operation with sound reproduction. If record in that claim means record material then the claim is one for a lost motion device common in all the arts. We know of no Court who have given it so broad a construction. And yet such construction is necessary to cover us.

Situation

The situation then is this; record in cl 21 means undulations ~~in cl 21~~ and not record material and hence we do not infringe. 2nd No court has ever decided that record in cl 21 means record material and hence complainants have no adjudication on which to found a preliminary injunction.

It is my intention in opening this case to present to the court merely a brief statement of the facts and of the points of law involved. On a motion for a preliminary injunction the court below held that the defendant's machine, (the graphophone) infringed claim twenty-one of the complainant's patent, and enjoined the defendant from further violation. The claim in question covers the use in a machine for recording and reproducing sounds, of a reproducer mounted on a universal joint and held against the record by yielding pressure. The invention covered by the patent in suit can best be illustrated by one of the complainant's machines which operates in accordance with the specifications of the patent. An inspection at the same time of the defendant's machine will show how far, if at all, it infringes on the complainant's invention. I have here the two machines and also diagrams on a large scale, illustrating the special features of them involved in this motion. As will be seen, the complainant's machine consists of a lathe carrying a mandrel on which is slipped a hollow cylinder of a wax or wax-like substance. This is called the "record tablet". A feed mechanism carries an arm supporting the recorder and reproducer along parallel with the surface of the cylinder. As the cylinder revolves the feed mechanism causes the recorder to trace a helical groove in the tablet. When the reproducer is used the reproducing point follows this helical groove. The recording and reproducing points vibrate vertically to the record surface. The recording diaphragm is in a plane parallel with the tablet surface. In recording, the sound waves strike the diaphragm and cause it to vibrate toward and away from the cylinder so the recording point cuts a groove in the cylinder with indentations and elevations in it. The recording point is rounded with cutting edges, and in recording, cuts away the material of which the cylinder is composed. It follows from this that the groove narrows slightly where there are elevations in the bottom of it, and widens where there are depressions. As the groove is extremely shallow for its width, it follows that this narrowing and widening of the groove is very slight in comparison with the magnitude of the elevations and depressions at the bottom. In reproducing, the operation of recording is repeated, except that the reproducing stylus is ball shaped, and does not cut the substance of the record. It follows the elevations and depressions in the groove and so transmits to the diaphragm the vibrations which cuts the groove. I show ~~the~~ a diagram on a large scale, giving a vertical section of a graphophone cylinder, having a record cut on it showing the shape of the grooves and the reproducing stylus in one of the grooves.

The gramophone mechanism is entirely different in its essential features. The record is made on a zinc disc. That disc is covered with a very thin wax coating. The recording diaphragm is supported with its plane at right angles to the surface of the disc. The recording stylus projects at right angles from the diaphragm and then is bent at a right angle so as to be parallel with the diaphragm, and yet to touch the surface of the disc at right angles to that surface. When the sound waves impinge on the diaphragm,

they cause the recording point to vibrate in a plane parallel with the surface of the disc. As the point vibrates, the disc is revolved and the point is moved by feed mechanism from the circumference of the disc towards its center, so that it traces a spiral line on the disc. The point does not cut the wax, but merely displaces it. After this record has been traced in the wax surface, acid is applied and eats out the zinc on the lines of the tracing. This forms a matrix from which records for reproducing are formed in hard rubber, by moulding. One of these hard rubber records is on the machine shown here. That machine can be only for reproducing, unlike the graphophone which can be used for both recording and reproducing.

The arm carrying the reproducer is mounted on a universal joint and presses against the tablet by gravity. There is no feed mechanism and the reproducing point is carried along the spiral lines on the disc by means of the groove in the disc. The actual record is found in the sides of the groove. As will be seen by the accompanying diagram, this record consists not of elevation and depression, but of irregularities in the side walls of the groove. The only function of the bottom of the groove is to act as a feed mechanism to carry the reproducing point along so that its sides engage the irregularities in the side walls of the groove. The diagram I have just referred to is a very much enlarged sketch of a portion of one of the discs showing the appearance of some of the grooves magnified. I also show you another sketch, giving a vertical section of the disc, showing the character of the grooves. It is instructive to

see the difference between them and the grooves of the graphophone record.

A word or two about the condition of the art and the history of these two inventions may make the essential differences between the two machines more clear. R ecording sound is older than reproducing. One of the best known early efforts in that line is Scot's phonautograph. He coated a paper cylinder with lamp black and caused a point attached to a diaphragm to trace a helical line on the cylinder. Sound waves impinging on the diaphragm moved the point in a pnale parallel to the surface of the cylinder, and visual representations of the sound waves were traced in the lamp black. The same thing was done by others in soft wax. Edison was the first one who reproduced sound from those sound records. The early visual records had all been made in a substance too soft to be reproduced from. He caused the sound record to be made in various harder substances and obtained his best results by indenting tin foil, wrapped around a grooved cylinder. This record was sufficiently durable to be able to impart the vibrations recorded on it to another diaphragm by means of a reproducing point passed over the record. His mechanism was in all essential particulars the same as that of the graphophone.

Bell & Tainter in their graphophone substituted a hard wax-like substance for the tin foil. The recording point therefore instead of depressing the substance as in tin foil, cut out a portion of it, leaving the record in the shape of a groove with indentations in the bottom and having

variable cross-sections. Their invention as described in their patent consists of a record tablet of a solid wax-like substance and cutting the record in it, as distinguished from indenting, (the tin foil method) or displacing (the Berliner method.) Another feature of their patent and one applied to the tablet it was not placed there with exactness.

The developement of the gramophone proceeded on entirely different lines. Mr.Berliner discovered and developed independently the method suggested by Scot. The sound waves in his invention are represented by lateral irregularities instead of vertical. The record is made in a wax too soft to permit of reproduction. It is then made permanent by etching, and copies made from this etched plate by a moulding process. The feed mechanism is entirely novel. The groove in the sides of which the record is being continued to a greater depth in order to act as a feed screw. This function of the groove is an improvement on the method shown in the early Edison disc machine. In that machine an independent spiral is used to propel the reproducer and recorder. In the gramophone that spiral is placed in the bottom of the groove which carries the record on its sides.

The court below has held that this reproducer of the gramophone is an infringement of claim 21 of the graphophone patent which claims:

> "21. The reproducer mounted on a universal joint and held against the record by yielding pressure substantially as described".

And has granted a preliminary injunction. The appellant disputes the correctness of that decree on three grounds.

1. The defendant's mechanism does not infringe the claim.

2. There has been no sufficient adjudication sustaining the validity of the claim or giving it a construction which would make the defendant an infringer.

If the adjudications construed the claim so broadly that the defendant is made an infringer, they are manifestly wrong on their face.

1.

The defendant's apparatus does not infringe the claim in question.

The claim contains three elements, the universal joint, the yielding pressure, and the holding of the reproducer against the record. The reproducing point in the gramophone is not held against the record by any pressure. The effect of gravity upon the reproducer arm is to press the point against the bottom of the groove in the tablet, but that groove is simply a feed mechanism for moving the reproducer point, and is not the record. The record is in the side of the groove.

of very questionable novelty, is the loosely mounted reproducer. They found that when the record was cut in wax the resistance of the wax increased very rapidly with the depth of the cut, and that a deep cut required more force than could be given to the recording point by means of the vibration of the diaphragm. They therefore made their cutting point round and broad, so as to cut a very shallow groove. For the same reason they made the grooves as narrow as possible, putting one hundred to the inch; more than twice the number of those of the tin foil machine. On account of the closeness of those grooves to each other and their shallowness, there was great difficulty in making the feed mechanism accurate enough to make the reproducer track perfectly: they therefore introduced between the feed mechanism and the point of the reproducing stylus a short section of rubber tubing, which allowed it lateral and vertical play: they also permitted the reproducer to rest against the tablet by gravity. By this means the groove containing the record was able to direct to some extent the motion of the reproducing point, whenever inaccuracy in the feed mechanism tended to draw it x away from the center of the groove. This play of the reproducer was also of use, of course, when the reproducer was first applied to the tablet, and enabled the point to seek the bottom of the groove even if, when first

The meaning of the word "record" as used in the patent is evident from the language of the patent and the use of the word. The record in the graphophone is the result of the action of the recording point in making the record, and the record consists of what the record point has done. This is an evident and accurate use of the word "record". What the recording point does is to cut out a portion of the material of the tablet; that groove so cut out then constitutes the record. That groove is distinguished by the depressions and elevation in the bottom of it, which grow lessand less as they go up each side, till at the top of the groove the efficient part of the record is in the bottom of the groove.

In the gramophone the record is formed by the displacement of the thin layer of wax on the zinc plate, and a copy of that record is made in the zinc by the etching effect of the acid which cuts a groove in the plate in the top of the sides of which groove the efficient record appear. The deeper part of the groove is not in any sense the record, but is merely a feed mechanism. One of the claims in Mr.Berliner's patents is the use of this groove delow the record for a feed mechanism.

The kind of record intended to be covered by the claim must be ascertained from an inspection of the patent. The invention of Bell & Tainter is a record in the form of a groove with sloping walls cut by a vibratory style in a wax-like substance and having the elevation and depressions corresponding to sound waves in the bottom of the groove. Claim 21 speaks of "the record", not "a record" or "any kind of record", and the word "the" clearly refers to the kind of record referred to in the specifications of the patent. It is true that in lines 1 to 3 of page 2 of the patent, a claim is made that this loosely mounted reproducer may be usefully employed in connection with forms of record other than a groove with sloping walls. This is a ~~sham~~ characteristic attempt of the patent solicitor by means of general language to embrace matters other than those in the mind of the inventor. It cannot be successful. The monopoly granted to the inventor is intended to cover only the matters invented by him. It is a reward for his inventive skill and is limited to the results attained by that skill. General language of that kind intended to make the monopoly

apply to matters not the subject of the invention, should not be regarded at all by the court. At the time this patent was granted there was no form of record known to the art capable of reproduction, except that of a groove with sloping walls. Had there been, it unquestionably would have been referred to in the patent, as its evident from the careful allusions to the prior art shown throughout it. Furthermore, in line with this contention, it is evident from other portions of the patent, that the use for which this loosely mounted reproducer held against the record by yielding pressure was intended, was to enable the reproducer point if it rested on the record groove at any place except the center of the groove, to find its own way to the center of the groove. While the patentability of such an obvious device to compensate for imperfection of mechanism or of adjustment, is very doubtful, its usefulness when applied to the record made by Bell & Tainter and to the only other successful record known, viz., the tinfoil record of Edison, is evident. In describing the function of the loose mounting of the reproducer,. the patent says, at page 1, line 80, that 'the advantage of the form of a groove with sloping walls is that it forms an efficient guide to the reproducing style'. At line 96, it says, in regard to the form of this loose mounting, that 'evidently there are many devices which can be used to pount the reproducer so that it is free to follow the sound record or phonogram'. On page 4, line 61, the patent says, that the reproducer in consequence of the flexibility of the rubber tubing, is free to follow the record.

The purpose of this loose mounting is further indicated on page 4, line 68, to 79.

"There exists always a liability to disarrangement in some part of the machine, either in the recorder or the support therefor, or the recording tablet or its support, or if there be no disarrangement, it would be difficult to insure that the producing style should touch the record precisely at the proper point, if the reproducer be held rigidly. Difficulties on these accounts are avoided by the loose or flexible mounting of the reproducer, the style automatically adjusting itself to the proper place on the record." The character of thi adjustment is further shown in the next sentence, where it says,

"The movement parallel to the face of the tablet would, however, by itself allow the style to follow and adjust itself to the record to a useful extent".

It is very evident from these descriptions, that the invention of the patentee is the use of a lateral and vertical motion combined with a yielding pressure to enable the reproducing point, when placed on any portion of the record groove, to gravitate to the bottom and to remain there regardless of any inaccuracy of the feed movement. This is further especially shown on page 4, line 62, where, in speaking of the use of the reproducer, it is said, "No special care is necessary to insure its adjustment, for, if the reproducer be allowed to rest against the record with the style upon the engraved line, the style will, of itself, gravitate to the bottom of the groove".

II.

The "record" spoken of in claim 21 is also a record formed by "cutting" as contradistinguished from the "displacing" by which the Berliner record is made. The fundamental basis of the B ell & Tainter patent is the alleged discovery of the cutting method and it is insisted on at length all through the patent. The specification even goes further and especially eliminates displacement from the patent. It says on page 6, line 75, "The displacement of material is not only a different operation from the cutting contemplated by this invention, but is not calculated to accomplish the objects for which cutting or engraving is employed". In addition to the defendant's original record being formed by displacement, it must be remembered that the record used with the defendant's machine is made by moulding from a matrix etched from lines formed by displacement; a far remove from cutting.

The record described in the claim must also be a wax record. The basis of the patent and its chief claim for novelty is the formation of a record in wax of such solidity that it is capable of reproduction. On page 2, line 11, the patentees state, "So far as we are aware no one has reproduced sounds froma wax record by rubbing a style or reproducer over it". It is true that the specifications state that the invention relates to the formation of the record in solid substances, but that is admittedly old, as records have been theretofore formed in soft wax and in lamp black, and the use of wax sufficiently hard to reproduce from is the only thing that can be claimed to be new. It was on that that Judge Shipman mainly based his decision in the

Leeds case.

Also the record described in the claim must be one made by a vibratory style. No other is contemplated in the patent, and wherever the method of making the record is described, reference is made to the sound waves impinging on the diaphragm which vibrates the style. In the defendant's machine the record is formed as explained before, by moulding, and the original record formed by the vibratory style is never used for reproducing; so while the defendant makes a record with a vibratory style, they never use the combination of a reproducer with a record made by a vibratory style.

Also the record described in the claim is a record consisting of a groove with depressions and elevations in the bottom of the groove and with variable cross-sections. These two characteristics are necessary incidents of any cutting style vibrating vertically to the surface of the tablet. The patent on page 1, line 78, says, that in the record, "the sound waves being represented by elevations and depressions at the bottom of the groove". In the claims of the patent the charges are run upon these two characteristics of the record, viz., the elevation and depression in the bottom and the variable cross sections. To the sentence just above quoted, "or otherwise" is added. This like the similar clause above referred to, is an invention, not of the patentee, but of the patent solicitor, and is so indefinite as to be entirely meaningless.

There is one other allusion in the patent to a record other than the engraved tablet. It is found on page 4, line 34, where the specifications speak of, "reproducing

from the engraved tablet or from other suitable record". This expression "other suitable record" may be taken as referring to the Edison tinfoil record, which is spoken of on page 1, line 34 of the patent, or to the Reynolds cut record, which is referred to on the same page, line 37, but no doubt the truth is that the patentee had no other form of record in mind. The allusion to the tinfoil record and to the Reynolds record just referred to, is instructive in that the patentee has mentioned every form of record then known in the art, and while the Berliner record might be considered as a developement of the earlier work of Scot and others, the patentees evidently did not consider that any record capable of reproducing could be made on those lines, and had not any such record in mind when applying for their patent.

2.

The complainant have obtained no adjudication covering the defendant's apparatus.

The only decisions that have been rendered are those of Judge Grosscup in the Amet case, and of Judge Shipman in the Leeds case. Taking Judge Shipman's decision as favorable as possible to the complainant, they are left in this position. Judge Grosscup has decided that claim 21 is invalid through lack of novelty, while Judge Shipman has decided that under certain constructions it is valid. With two Circuit Courts at variance on this vital point, it would seem that the question is so far open that a preliminary injunction should not issue, except in a case identical in all respects with that on which the favorable decisions was rendered. If, however, Judge Grosscup's plain decision, that claim 21 is invalid, be disregarded, and the intimation as to its validity contained in Judge Shipman's decision is followed, still there is no sufficient adjudication on which to found this preliminary injunction. All that Judge Shipman decided was that a reproducer mounted on the universal joint and held by yielding pressure against a record cut by a vibratory style in a wax-like substance, consisting of a groove with sloping walls with the sound waves represented by elevations and depressions at the bottom of the groove, infringes claim 21. For the purposes of this argument, we will admit, as was taken for granted by Judge Grosscup and decided by Judge Shipman, that the cut record in a wax-like substance is novel and patentable, and that a reproducer of the kind described in claims 19 to 24, when used in combination with or held against a record of that character, is an infringement of those claims. But, as already explained, the record used by the defendants has none of the above qualities, and the reproducer used by them is not held against the record by yielding pressure. The only reasonable construction to give to Judge Shipman's opinion, (when we take into consideration the fact that he fails to decide expressly as to whether or not a reproducer mounted on a universal joint is patentable) is that he considered that the words in the claim, "held against the record substantially as described", meant against a record of the character used ~~by~~ both by Amet and by Leeds.

Be this as it may, it is certainly an elementary

principle of law that in a motion for a preliminary injunction, if a claim that has been held to be valid is capable of two constructions, one of which is not applicable to the apparatus attempted to be enjoined, and the claim has never received such a construction in any adjudication, no preliminary injunction should go; but the defendants should be entitled to go to final hearing for a construction of the claim. That is exactly the present case.

3.

If the broadest possible construction is given to Judge Shipman's decision and he is assumed to have held the claim to be valid, no matter against what kind of a record the recording point is held by the yielding pressure, his decision is wrong; for the claim if so construed evidently is invalid, both from lack of novelty and on account of prior publications.

The lack of novelty is evident as the mechanism is nothing but a very obvious method of making allowance for inaccuracies of machinery. Any mechanic of ordinary skill who has before him the problem of making a tracing point follow an irregular groove in a case where the machinery was liable to be out of true, the first thing which would suggest itself to him would be a slightly loose mounting to give play to the follow point, and, of course, a yielding pressure to enable the loose mounting to be effective. The term "yielding" is really very deceptive, as it is employed in almost every form of pressure except possibly a form where, like a paul and ratchet movement can be made only in one direction. Any rigid mounting of the reproducing arm

would be without pressure, and any loosely mounted arrangement must involve a yielding pressure. Any pressure in a case like the present must necessarily be a yielding pressure.

This universal joint and yielding pressure is shown in Edison's English patent. Figures 1 and 2 show an arm mounted on horizontal and vertical pivots which constitute a universal joint, and the recording point is held against the record by gravity. Any irregularity that would cause the record tablet to raise would, if pressed sufficiently hard against the arm, raise it. So the pressure of the reproducing point upon the record is of a yielding character. If it is suggested that the arm is too heavy to be easily raised, it is answered that is a question of the decree of the pressure, not of its yielding character; and a glance at the mechanism shows a compensating handle on the opposite side of the horizontal pivot, which evidently would compensate for most of the weight of the arm. The fact that this arm rests on a collar which acts as a stop, does not alter the character of the pressure; it only puts a limit to it. If the complainant's machine, and in fact in any machine of this character, there must be a limit of motion somewhere; and so long as that stop does not prevent the reproducing point from reaching the lowest indentation in the record, the point is held against the record by yielding pressure. The description of this machine in the specifications shows that the reproducing point is to follow the track of the recording point. From this it is evident that the reproducing point must, when the machine is adjusted, go to the bottom of the lowest depression, That answers the above suggested requirement.

It has been suggested that the feed mechanism in the middle of the disc shown in figures 1 and 2, carries the weight of the arm so it does not rest on the record; but a variation of that mechanism is shown in figures 3 to 9, in some of which it is evident that the feed mechanism cannot carry any of the weight of the arm. This is notably so in figure 9, where a spring arm bears against a fusee, and, as the fusee turns carries the reproducer arm laterally. A glance at this mechanism shows that the spring resting against the fusee would carry none of the weight of the arm.

The points, therefore, relied upon on this argument, are

1. That the defendants do not infringe, as the recording arm in their apparatus is not held against the record, and the record used by them is not the kind of record described in claim 21;

2. That there is a doubt as to the validity of claim 21, as two Circuit Courts have decided diametrically opposite in regard to it;

3 That if claim 21 is valid, there has been no adjudication construing it so that it covers the defendant's machine:

4. If the claim be attempted to be construed so as to cover the defendant's machine, it obviously is invalid.

For these reasons the order for a preliminary injunction should be reversed.

Leg[illegible]

THE NATIONAL GRAMOPHONE COMPANY :
:
-ADS- : MEMORANDUM.
:
AMERICAN GRAPHOPHONE CO. :

The questions involved are as to the claims in patent 341,214 in regard to the reproducer, especially claim 21. ~~twenty-one~~. That is for a reproducer mounted on a universal joint held against the record by yielding pressure. This claim contains three elements. The movement of the reproducer parallel with the surface of the record tablet which I will call the lateral motion, the motion of the reproducer at right angles to the surface of the record tablet which I will call the vertical motion, and the holding of the reproducing stylus against the record by yielding pressure. It is suggested in Mr. Berliner's affidavit that this yielding pressure is supplied in the earlier machines by the yielding of the diaphragm, but I think a fair construction of the patent would show that this claim covers a pressure holding the entire reproducing apparatus, including the arm or other appliance~~s~~ on which it is mounted, against the record. This yielding pressure must be entirely separate and uninfluenced by the pressure on the stylus against the diaphragm which causes vibrations which create the sound.

The function of the union of these three elements is important in the case. In the graphophone the function of these elements when combined together is entirely to permit the reproducing stylus to adjust itself automatically to the sound record, and is only necessary on account of imperfections in the machinery or eccentricity of the cylindrical tablet.

The lateral motion makes allowance for the irregularities in the feed mechanism; but this would not be sufficient for that purpose, although the specifications of the patent say that such a lateral motion would of itself be useful. That it would not be sufficient is evident because no amount of lateral motion would enable the reproducer to descend to the bottom of the groove without also vertical motion and pressure against the record. If there was any yielding vertical motion the record could not leave the groove, so the lateral motion would be entirely ineffective. It would seem to be arguable from this that this claim should have read into it the clause ~~as~~ that appears in the other claims, viz: that this construction is for the purpose of enabling the reproducer to adjust itself automatically to the record. This would seem to be in accordance with the testimony given by expert

Browne in the Leeds & Baldwin case.

The vertical motion also has usefulness in permitting the reproducer to be adjusted by hand to any part of the record. This element of it, however, can be shown to be old in the art.

¶ In ~~a~~ the case of the gramophone the lateral motion is for an entirely different purposes. It is to enable the reproducer to follow the track of the recorder, which is a necessary incident in every talking machine. The vertical motion and yielding pressure, however, ~~with~~ we must admit is for the same purpose as the same element in the graphophone. It is stated in the affidavits that the vertical motion in the gramophone is only to enable the reproducer to be adjusted by hand, but if that were the only purpose of the vertical motion with yield-

ing pressure, that yielding pressure could be ~~expunged~~ dispensed with and stop inserted ~~made by~~ stopping the vertical pressure ~~at a point~~ just ~~above~~ before the point of the reproducer ~~which~~ touches the surface of the record. If the tablet in the gramophone rotated in a mathematical ~~plain~~ plane, it is evident that such a construction would permit a much ~~larger~~ better reproduction to be made. But on account of the necessary warping and irregularities of the record tablet, the vertical motion with yielding pressure is given to the recorder arm to permit the reproducing point to keep in contact with the record, notwithstanding these irregularities. It is also evident that a vertical motion can be of no advantage in reproducing, as the best records that could be made, would be made by rigidly supporting the reproducing arm so that the point of the reproducing stylus follows exactly the track of the recording stylus with no additional motion of the arm and diaphragm which additional motion must to a certain extent, effect the ~~of the~~ vibrations ~~indicated~~ communicated by the reproducing style, ~~and~~ it also must tend to make the reproducing point in a graphophone skip over some of the sharper and smaller indentations, because any raising of the reproducing arm must be followed by a falling of it into the following indentation, and that falling action sometimes will not be sufficient quite to enable the point ~~the point~~ to fit into every sharp indentation. The above shows that the function of these three combined elements in the claim which is useful in the graphophone does not apply to the gramophone; as one of them, the lateral motion, has an entirely different function.

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¶ I think we can unquestionably show that both the lateral motion and the vertical motion are old in talking machines, but it is a question whether the yielding pressure to compensate for the eccentricities or irregularities in the record tablet can be shown, and also whether the combination of the three elements for the sake of enabling the reproducer ~~to~~ automatically to adjust itself to the record can be shown in the early patents.

The lateral motion is common to the early mechanism, and is a necessary part of any talking machine of which the record is made on a disc. If the record is made on a disc the recording point must have a lateral motion parallel with the face of the tablet and the recording stylus must, of course, have a similar motion in order to follow the track of the recording stylus. This construction is shown in figure ~~one~~ 1 and ~~two~~ 2 of Edison's English patent and is sufficiently described in the specifications. This same lateral motion, of course, appears in apparatus having a cylindrical tablet where the tablet is stationary and the reproducer moves along it. The vertical motion with yielding pressure is also found in the talking machine described in the earlier patents, but there is a good deal of doubt as to whether in them the vertical motion and yielding pressure are combined for the same purpose. In the figures 1 and 2 of the English patent, there is a vertical motion of the reproducer arm and the reproducer stylus is kept down on the record by gravity. There is in the mechanism a collar which stops the vertical pressure at a certain point. In order to have the vertical movement and the yielding pressure combined for the function shown in the graphophone patent, the stop must be at such a distance as to permit the point of the reproducing stylus to reach the lowest indentation in the lowest part of the record, and the pressure must be sufficiently yielding to allow any irregularity in the record tablet to raise the arm carryong the reproducing stylus without destroying the record. In this figure one and two, to have the machine operative, the collar must be sufficiently low so that the reproducing point can reach the lowest indentation at the lowest part of the record, and it is also arguable that in order to have the machine operative the weight of the reproducing arm must be so nearly balanced by the counter weight on the other side of the horizontal pivot as to enable the record surface to raise it so that the point can adapt itself to any irregularity in the record tablet. Whether that is sufficiently obvious to convince a court of its use may be considered doubtful. There seems to be nothing in the specifications of the English patent to indicate that possible irregularities in the surface of the record tablet were taken into consideration by Mr. Edison in making this ~~disc~~ design. There are, however, these phrases. On page

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3, line 1 of the Provisional Specifications, he says that the ~~apparatus~~ apparatus of the talking machine must be adapted to bring the phonogram into contact with the phonet or speaking part of the apparatus, and on line 27 he says that the point of the reproducer must "follow the bottom of the depressions". On page 4, lines 26 to 33 indicate that the reproducing point is pupposed to follow all the indentations ~~of the~~ of the recorder. To accomplish these objects on an ordinary commercial machine built on the lines of ~~pha~~ figures 1 and 2, the yielding vertical motion in question must certainly be provided for. In the figures of Edisons first American patent nothing is shown indicating a yielding vertical pressure, but in the specifications in the first column of the second page he speaks of an apparatus for a phonograph consisting of a disc like figure 1 and 2 of the English patent with the difference that the arm is moved vertically by a spiral cut on the under side of the record tablet and the arm is a double arm, a point engaging the lower side of the tablet while the phonographic points are in contact with the upper side. He refers immediately afterwards to an apparatus of that character shown in his patent 213,554 and reference to them will, I think show that the mechanism of that apparatus provides for a yielding vertical pressure. It is an automatic telegraph. The surface of the disc is cut in a spiral groove upon which he has pasted paper ; a double arm pivoted vertically engages on the under side of the disc a spiral corresponding with the spiral grooves on the top. The upper arm rests upon a spring No.13 shown in figures 4 and 5. The weight of the upper arm pressing down presses the lower arm up against the lower side of the tablet. When that lower arm is in contact with the under side of the tablet it stops the motion of the upper arm. In order, however, as I understand the diagram, to prevent this stop action from keeping the upper arm with the upper surface of the tablet, this spring No.13 is provided. That evidently causes a yielding pressure on the tablet. ~~If~~ To the

operation of the apparatus a point is fastened to the upper side of the under arm by a spring and magnetic action causes that arm to vibrate a point which indents the paper on the upper side of the tablet. To reproduce, this same point is carried over the surface of the tablet in the manner indicated in figures one and two, and is vibrated by the indentations in the paper, and these vibrations are carried telegraphically to other instruments. We have in this machine the vibrating point and the arm moving vertically with yielding pressure, which vertical movement is independent of the vibrations of the vibrating point. It seems to me that this mechanism is identical with that of the gramophone in construction and function, except that the spiral causing the lateral motion is underneath the tablet instead of upon it. This apparatus too differs from the graphophone in the same way that the gramophone does, in that the vertical motion and yielding pressure is calculated to make allowance for the irregularities in the tablet surface, while the lateral motion is only for the purpose of causing the vibrating point to follow the previously made record. This patent ~~r The patent~~ was granted March 25th.,1879. In Edison's later patent in May 1880, figures 3 and 4 shows a mechanism having both the lateral and vertical motion, the lateral for the purpose of causing the reproducing point to follow the record groove, and the vertical for the purpose of placing the point in the proper place on the record and (arguable) for the purpose of making allowance eccentricity of the record tablet. In this case as in the figure in the English machine, there is a stop device stopping the vertical motion, but the pressure is given by means of a spiral spring instead of by gravity, and from the appearance of the machine it is evident that a eccentricity of the tablet would move the arm carrying the reproducing point vertically without destroying the indentations in the tin foil. If this eccentricity became toogreat, it would disengage the feed mechanism, and if there were a depression in the tablet too great, the point could not follow it. This is caused by the action of the stop mechanism which gives a play merely of the depth of a screw thread, and not as in the gramophone claim where the play indicated is practically limited. In this machine I am speaking of the record as on an upright cylinder. This cylinder has on the lower part of it a screw thread. There is an upright standard along side of the cylinder upon which fits a sleeve the length of the standard which turns on the standard, and on that sleeve is a collar carrying the recorder and reproducing arm.

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This ~~collar~~ sleeve seems to be held to the tube sleeve by an adjustable cam action so that it can respond to a downward pressure, but when the pressure ceases it is held in position. On this collar is a screw thread which engages the screw thread on the cylinder when the machine is in position for operation. This engagement is made by a spiral spring which revolves the sleeve.

When the screw threads are engaged and the cylinder is revolved a motion parallel to the tablet ~~service~~ surface is communicated to the arm. In speaking of this spring the specification says on page 2, line 50, that the spring will "serve to turn the ~~two~~ tube, the sleeve and the diaphragm and arm with sufficient force to bring the point D (the reproducing point) to bear upon the foil with the required force".

These two screw threads form the a stop, and the limit of the efficiency of the yielding pressure ~~to~~ the arc that can be described by the end of the arm without disengaging the screws thread.

The propositions which I think can be maintained are:

1. The Claim 21 must be construed to be limited to such ~~action~~ a combination of the three elements described in it as has for its function the automatic adjustment of the reproducing point to the record.

2. These three elements while present in the gramophone are not ~~united~~ combined for that purpose.

3. These three elements ~~used~~ combined for the purpose that the gramophone ~~uses~~ combines them are old in the art.

4. The three elements combined (for the purpose for which they are combined in the ~~gramophone~~ graphophone appear in the Edison Automatic Telegraph patent No. 218,584, connected with the phonographic art by the reference in patent No 200,521; and possibly in the figures 1 to 9 in the English patent, and in the Edison U. S. Patent 227,679, figures 3 & 4.